International Edition

September 1983 $2.49½
Issue #276

73

Amateur Radio's Technical Journal

A Wayne Green Publication

Space Shuttle Astro-Hamming
Page 8

Wayne Green Sells Out?
Page 6

Pyramid Portable
Page 135

Report from Poland
Page 138

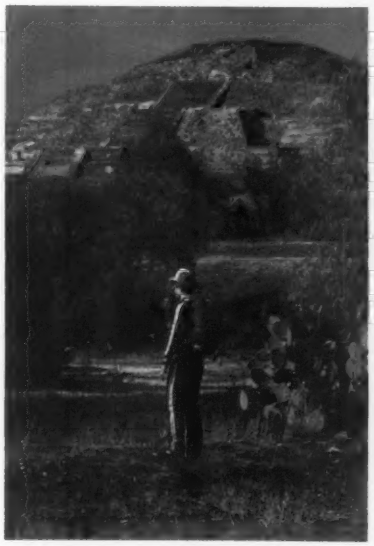
Bake Your Own Apple
Page 40

CoCo RTTY!
Page 58

How to Packet
Page 19

Heath's New CW Terminal
Page 94

Teotihuacan—135



"10...9...8..."
Be ready when the Space Shuttle *Columbia* carries aloft the first astro-ham. Here's the best way to contact this historic DXpedition. WA6ITF 8

Join the Packet-Radio Revolution
Get error-free, high-speed communications. Packet radio's chief architect, WA7GXD, explains what it is and how it works. WA7GXD 19

Be a RTTY Rembrandt
Put that award-winning shine on your RTTY pix with these tips from a RTTY artist's sketchbook. WA2OQJ 28

How to Increase Your QSOs
N6HYK's seasoned advice will add spice to your CW contacts—even if you aren't a Novice. N6HYK 34

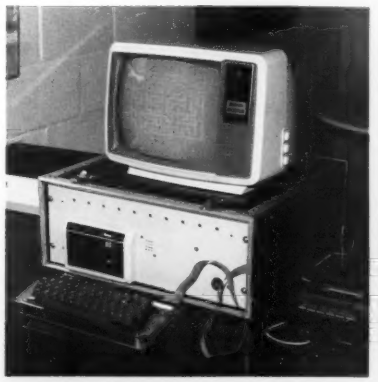
Home-Brew an Apple Computer—and Save!
In this *73* exclusive, KB2GA reveals the secrets of Apple construction. From keyboard to motherboard, it's all here. KB2GA 40

Build This Super Switch
The only thing this switch won't do is brew your coffee. It's the lazy man's delight. K4YS 52

The Amazing Cylindrabola
This microwave antenna is easier to build than a dish. But it works just as well. WA4WDL 54

Colorful RTTY: An Advanced System for the TRS-80C
It's all here—a TU, program, and modem to turn your CoCo into a professional-quality RTTY terminal. K6AEP 58

Never Say Die—6
FCC—50
Gift Subscriptions—67
73 International—70
Contests—84
Social Events—86
Satellites—89
Ham Help—89, 100, 120
Corrections—89
Review—90
DX—96
Dr. Digital—98
RTTY Loop—102
Letters—102
Awards—104
New Products—106
Reader Service—114
Fun!—116
Dealer Directory—146
Propagation—146



Your Own Apple—40

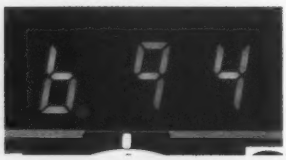
0 74470 65946 09

ICOM IC-25A/H

More Features and Power Per Square Inch!

NOW WITH **EXTRA POWER!** IN THE NEW 25H MODEL

The smallest 2 meter FM mobile on the market is now even easier to read and use with a green LED readout and a compact touchtone®/scanning microphone and gives you the option of 25 or 45 watts.



New Green LED. Easier to read in bright sunlight, and not glaring at night, the IC-25A(H)'s new readout provides good visibility under all conditions.

5 Memories. Instant access to most used frequencies. VFO A information is transferred to the selected memory by pushing the write button.

Priority Channel. Any memory channel may be monitored for activity on a sample basis, every 5 seconds, without disruption of a QSO conducted on a VFO frequency.

New HM14 Microphone. Smaller and lighter . . . the HM14 microphone provides a 16 button touchtone® pad as well as up and down scan buttons adding easy frequency control of the radio and additional tones for repeater control.

NOR/REV Capability. Use of this button in the duplex mode allows one touch monitoring of the repeater input frequency. If simplex operation is possible you will know instantly.

Scanning. Pushing the S/S button initiates the scan circuitry. With the mode switch in a memory position the unit will scan all 5 memories plus the 2 VFO frequencies. With the mode switch in a VFO position, the unit will scan the entire band or the portion of the band defined by memories 1 and 2. Full band scan or program band scan is selected from the front panel and internally switched scanning choices of adjustable delay period after a carrier is received then resume scan, or resume on carrier drop, are standard.

The New 45 Watt IC-25H. Only slightly longer than its companion IC-25A, the IC-25H packs a powerful 45 watt punch. This 45 watts of power eliminates the need for an external power amplifier in fringe areas and gives a savings of space and wiring.

The IC-25H has all of the standard features of the IC-25A that have made it the most popular 2 meter mobile ever, plus the new green LED readout, new HM14 microphone and extra power. These new features make the IC-25H the best 2 meter mobile value on the market.

ICOM
The World System

ICOM America, Inc., 2112-116th Ave NE, Bellevue, WA 98004 **(206)454-8155** / 3331 Towerwood Drive, Suite 307, Dallas, TX 75234 **(214)620-2780**

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

5-STORE BUYING POWER in action!

Unlike some retailers, when Ham Radio Outlet guarantees satisfaction there'll be no question. *YOU CAN COUNT ON IT!*

KENWOOD BIG VALUE COMBINATIONS

TS-930S

with Antenna Tuner
Plus
3 Free Bonus Items

1) SP-930 Speaker.
2) MC-60A microphone.
3) YK-88C-1 filter.

REG. $2029 VALUE
$1799
A $230 SAVING

TS-430S

Buy a TS 430S for
$899.95
and select your free package from among the following three groups:

1) MB-430. FM-430. YK-88A
$119.85 value.
or
2) MB-430. MC-42S. YK-88 SN.
$112.85 value.
or
3) Ham Radio Outlet
$90 CASH REBATE.

NEW!! TW-4000A

FM "Dual Bander"
2m and 70cm in a single package!

Buy a TW 4000A for
$599.95
and select two of the following items absolutely free!

1) VS-1 Voice Synthesizer. $39.95 value.
2) TU-4C sub-audible tone generator. $39.95 value.
3) MA-4000 Duo-band Mobile Antenna. $44.95 value.

PLUS FREE SHIPMENT (UPS Brown) FOR ALL COMBINATIONS

ICOM

NEW!! IC-751
RETAIL PRICE
$1399
CALL FOR YOUR SPECIAL PRICE

YAESU

FT-208R **FT-708R**

CALL FOR LOW PRICES ON HAND-HELDS and all YAESU ITEMS.

NEW!
FT-980

MIRAGE

B-3016 REG. $239.95
SALE $199.95

B-1016 REG. $279.95
SALE $249.95

B-108 REG. $179.95
SALE $159.95

B-23S REG. $89.95
SALE $79.95

KLM

KT-34A
SALE $299

KT-34XA
SALE $459

PRICES ARE FOB CALIF. EXCEPT FOR CERTAIN COMBINATIONS. PLEASE INQUIRE

Tri-Ex

W-51
SALE $799
W-36
CALL FOR PRICE
LM-470D
CALL FOR PRICE

FREE SHIPMENT (U.P.S. Brown) CONTINENTAL U.S.A

ON MOST ITEMS THAT CAN BE SHIPPED UPS BROWN.
THERE ARE SOME EXCEPTIONS IN ALPHA, TRI-EX AND KLM

SERVING HAMS BETTER.
North...south...east...west.

Bob Ferrero, W6RJ
Jim Rafferty, N6RJ
other well known hams give you courteous, personalized service.

FREE PHONE 800 854-6046

9:30AM to 5:30PM PACIFIC TIME.

OVER-THE-COUNTER, 10AM to 5:30PM.
MONDAY THROUGH SATURDAY

CALIFORNIA CUSTOMERS PLEASE PHONE OR VISIT LISTED STORES.

HAM RADIO OUTLET

ANAHEIM, CA 92801
2620 W. La Palma,
(714) 761-3033 (213) 860-2040
Between Disneyland & Knott's Berry Farm

BURLINGAME. CA 94010
999 Howard Ave., (415) 342-5757
5 miles south on 101 from S.F. Airport.

OAKLAND, CA 94609
2811 Telegraph Ave., (415) 451-5757
Hwy 24 Downtown. Left 27th off-ramp.

SAN DIEGO, CA 92123
5375 Kearny Villa Road (619) 560-4900
Hwy 163 & Clairemont Mesa Blvd.

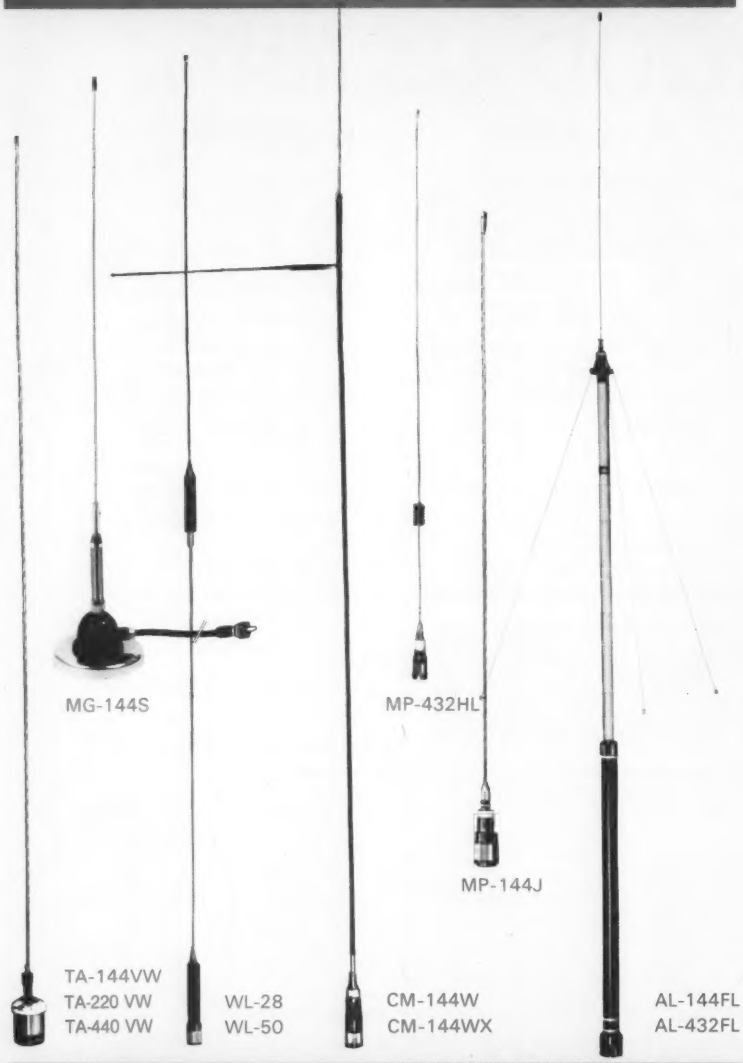
VAN NUYS, CA 91401
6265 Sepulveda Blvd., (213) 988-2212
San Diego Fwy at Victory Blvd.

AEA • ALLIANCE • ALPHA • AMECO • AMPHENOL • ARRL • ASTRON
AVANTI • BELDON • BENCHER • BERK-TEC • BIRD • B & W
BUTTERNUT • CALLBOOK • CDE • COLLINS • CURTIS • CUSHCRAFT
DAIWA • DRAKE • DX EDGE • DX ENGINEERING • EIMAC
HUSTLER • HY-GAIN • ICOM • J. W. MILLER • KANTRONICS
KENWOOD • KLM • LARSEN • LUNAR • METZ • MFJ • MICRO-LOG
MINI-PRODUCTS • MIRAGE • NYE • PALOMAR • ROBOT • ROHN
SHURE • SIGNAL-ONE • TEMPO • TEN-TEC • TRISTAO • VOCOM
YAESU and many more!

Prices, specifications, descriptions subject to change without notice. Calif. residents please add sales tax

MAXIMIZERS

NEW



Get the most out of going mobile with KLM's hot new ***MAXIMIZER*** base/mobile and handi antenna series. Single and multiband models from 21 to 440 MHz deliver ***MAXIMUM*** coverage and performance without frills or compromise.

MAXIMIZER **mobile sampler:** TA-series: 1/2λ whips for 144, 220, and 440 MHz voltage protection.

MG-144S: 1/4λ monopole with powerful magnet mount.

WL-series: center loaded whips for 28/21, 28 and 50 MHz

MP-432HL: 5/8λ + 3/8λ whip for 432 MHz

CM-series: multiband whips for 15/10/6/2 meters or 10/6/2 meters.

AL-series: high gain 1/4λ for mobile/handie applications.

There's more! See your KLM dealer or write for a catalog.

KLM Electronics Inc.

KLM Electronics, Inc. P.O. Box 816, Morgan Hill, CA 95037 (408) 779-7363

INFO

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request.

Editorial Offices:

Pine Street
Peterborough NH 03458
Phone: 603-924-9471

Advertising Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-7138

Circulation Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-9471

Subscription Rates

In the United States and Possessions:
One Year (12 issues) $25.00
Two Years (24 issues) $38.00
Three Years (36 issues) $53.00

Elsewhere:

Canada and Mexico—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire.

To subscribe, renew or change an address:

Write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. For renewals and changes of address, include the address label from your most recent issue of *73*. For gift subscriptions, include your name and address as well as those of gift recipients.

Subscription problem or question:

Write to *73*, Subscription Department, PO Box 931, Farmingdale NY 11737. Please include an address label.

73: Amateur Radio's Technical Journal (ISSN 0745-080X) is published monthly by Wayne Green, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Entire contents copyright© 1983, Wayne Green, Inc. All rights reserved. No part of this publication may be reprinted or otherwise reproduced without written permission from the publisher. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. Postmaster: Send address changes to *73*, Subscription Services, PO Box 931, Farmingdale NY 11737.

WE WANT YOU!

TO CALL TOLL FREE

1-800-325-3636

FOR A TRADE-IN QUOTE

We Trade on New or Used Equipment

(Check for prices on available used equipment)

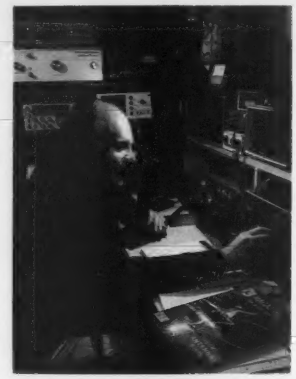
HAM RADIO CENTER

8340-42 Olive Blvd. • P.O. Box 28271 • St. Louis, MO 63132

VISA

In Missouri Call 1-314-993-6060

MasterCard



W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

GREEN SELLS OUT

In a way, I suppose you might say that I sold out, but I plead guilty with an explanation.

It all started last spring when some chaps from one of the bigger banks called saying that they had a large foreign publisher who was looking to acquire something like my micro publishing empirette. I wasn't much interested because I enjoy what I'm doing more than anything else I can imagine. But what would it cost to listen, right?

So they came to visit and looked over our place. I showed them our growth in sales, which has run around 50 percent a year for the last eight years. They mumbled vaguely about $50 million, which I have to admit got my attention. I'd really never given much thought to what the whole mess might be worth.

The word that I was thinking of selling began to spread, and new suitors started calling every few days. The more I talked with these firms, the more I realized that this probably was a good time to merge with a larger firm so that I would have the money to invest in some new projects. I have never had much of a personal need for money, so selling out for a big bundle of cash had little attraction.

No, it would be worth merging if I could get the money to start magazines at a faster rate and thus be able to keep up better with the needs of the microcomputer industry. And I had an idea for a new type of magazine I wanted to try out. If it worked, I'd have a way to get perhaps 50 more like it going, each with expected sales on the order of $5 million a ear or more.

Then th ere was my idea for a new type of school, a business/technical institute geared to the needs of the 80s. The more I thought about it, the more ideas for new divisions of Wayne Green, Inc., came to mind. With some cash available for getting these new businesses and publications going, we could step up our growth enormously. I did some sales projections and I could see us growing to a billion in sales within ten years just on the plans already in mind.

As I talked with the firms interested in merging, I found several of them excited about my ideas and plans. I'd had a good record of coming up with innovative ideas in the past, so there wasn't much skepticism about my new ideas. After all, I'd had the idea to start the first magazine for micros: *Byte*. And then I started the first system-specific magazine: *80 Micro*. And I'd pioneered mass-produced software. As I talked with people, I realized that I have a pretty good track record.

The final choice of a merger partner was most difficult. Several large firms put it bluntly: They needed me and I could name my price. Now I want to tell you, that is fantastic for the ego. I really wasn't into shopping around for the highest offer because the difference between $50 million and $100 million means a lot less than the compatibility of the merger. And numbers like that don't mean anything, anyway; they're just very big numbers.

On May 22nd, I signed a preliminary agreement with Pat McGovern, the publisher of the

Continued on page 116

QSL OF THE MONTH

This month's QSL card winner depicts a nighttime scene from the nation's capital, viewed from the Virginia side of the Potomac River. The Lincoln Memorial is in the foreground, with the Washington Monument and the Capitol in the background. Tom Dorset WB4J makes this card distinctive by using lowercase letters for his callsign, giving a modern feel to this traditional scene. Opposite Tom's callsign, a faint moon looks serenely over the entire panorama.

To enter 73's QSL of the Month contest, put your card in an envelope with your choice of book from 73's Radio Bookshop and send it to 73, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries not in envelopes and without a book choice will not be considered.

STAFF

PUBLISHER/EDITOR
Wayne Green W2NSD/1
EXECUTIVE VICE PRESIDENT
Sherry Smythe-Green
ASSISTANT PUBLISHER/EDITOR
Jeff DeTray WB8BTH
MANAGING EDITOR
John Burnett
ASST. MANAGING EDITOR
Susan Philbrick
EDITORIAL ASSISTANTS
Nancy Noyd
Richard Phenix
Steve Jewett
TECHNICAL EDITOR
Avery L. Jenkins WB8JLG
ASSISTANT TO THE PRESIDENT
Matthew Smith KA1IEI
ASSOCIATES
Robert Baker WB2GFE
John Edwards KI2U
Bill Gosney KE7C
Sanger Green
Chod Harris VP2ML
Dr. Marc Leavey WA3AJR
J. H. Nelson
Bill Pasternak WA6ITF
Peter Stark K2OAW
Robert Swirsky AF2M

PRODUCTION MANAGER
Nancy Salmon
ASST. PRODUCTION MANAGERS
Michael Murphy
David Wozmak
ADVERTISING GRAPHICS MANAGER
Scott W. Philbrick
DESIGN DIRECTOR
Christine Destrempes
PRODUCTION
Patricia Bradley
Linda Drew
Michael Ford
Marjorie Gillies
Donna Hartwell
Alfred Huston
Taylor Morris
Kimberly Nadeau
Lynn Parsons
Paula Ramsey
Anne Rocchio
Kenneth Sutcliffe
Theresa Verville
Robert M. Villeneuve
Karen Wozmak
PHOTOGRAPHY
Thomas Villeneuve
Sandra Dukette
Laurie Jennison
Sturdy Thomas
Irene Vail
TYPESETTING
Sara Bedell
Darlene Bailey
Prem Krishna Gongaju
Lynn Haines
Len Lorette
Debbie Nutting
Lindy Palmisano
Heidi Thomas
Sue Weller

GENERAL MANAGER/VICE PRESIDENT
Debra Wetherbee
CONTROLLER/VICE PRESIDENT
Roger J. Murphy
ACCOUNTING MANAGER
Knud Keller KV4GG/1
CIRCULATION MANAGER
Patricia Ferrante
603-924-9471
BULK SALES MANAGER
Ginnie Boudreau
1-(800)-343-0728
ADVERTISING
603-924-7138
Jim Gray W1XU, Mgr.
Nancy Ciampa, Asst. Mgr.
Ross Kenyon KA1GAV
Cornelia Taylor, Office Coordinator

FM "Dual-Bander."

NEW

2 m & 70 cm in single compact package, LCD, 25 W, optional voice synthesizer.

TW-4000A

KENWOOD's TW-4000A FM "Dual-Bander" provides new versatility in VHF and UHF operations, uniquely combining 2 m and 70 cm FM functions in a single compact package.

TW-4000A FEATURES:

- **2 m and 70 cm FM in a Compact Package** Covers the 2 m band (142.000-148.995 MHz), including certain MARS and CAP frequencies, plus the 70 cm FM band (440.000-449.995 MHz), all in a single compact package. Only 6-3/8 (161)W x 2-3/8 (60)H x 8-9/16 (217)D inches (mm), and 4.4 lbs. (2.0 kg.).
- **Large, Easy-to-Read LCD Display** A green, multi-function back-lighted LCD display for better visibility. Indicates frequency, memory channel, repeater offset, "S" or "RF" level, VFO A/B, scan, busy, and "ON AIR." Dimmer switch.
- **25 Watts RF Power on 2 m/70 cm.** Hi/Lo power switch.
- **Optional "Voice Synthesizer Unit"** Installs inside the TW-4000A. Voice announces frequency, band, VFO A or B, repeater offset, and memory channel number.
- **Front Panel Illumination**
- **10 Memories with Offset Recall and Lithium Battery Backup** Stores frequency, band, and repeater offset. Memory 0 stores receive and transmit frequencies independently for odd repeater offsets, or cross-band operation.
- **Programmable Memory Scan** Programmable to scan all memories, or only 2 m or 70 cm memories. Also may be programmed to skip channels.
- **Band Scan in Selected 1-MHz Segments** Scans within the chosen 1-MHz segment (ie., 144.000-144.995 or 440.000-440.995. etc.). The scanning direction may be reversed by pressing either the "UP" or "DOWN" buttons on the microphone.
- **Priority Watch Function** Unit switches to memory 1 for 1 second each 10 seconds, to monitor the activity on the priority channel.
- **Common Channel Scan** Memory 8 and 9 are alternately scanned every 5 seconds. Either channel may be recalled instantly.
- **Dual Digital VFO's** Selectable 5-kHz or 10-kHz for 2 m, and 5-kHz or 25-kHz for 70 cm. Depress "UP" or "DOWN" key on the front panel for band change in 1-MHz steps.
- **16-Key Autopatch UP/DOWN Microphone (Supplied)**
- **Repeater Reverse Switch**
- **High Performance Receiver/Transmitter** GaAs FET RF amplifiers on both 2 m and 70 cm, high performance MCF's in the 1st IF section, provide high receive sensitivity and excellent dynamic range. The high reliability RF power modules assure clean and dependable transmissions on either band.
- **Rugged Die-cast Chassis**
- **Optional Two-Frequency CTCSS Encoder** Easily mounted inside the radio, allows DIP switch programming of two different tone frequencies, for 2 m and 70 cm.
- **"BEEPER" sounds through speaker.**
- **Easy-to-Install mobile mount**

TW-4000A accessories:

- **VS-1 Voice Synthesizer**
- **TU-4C Two-Frequency Programmable CTCSS Encoder**
- **KPS-7A Fixed station power supply**
- **SP-40 Compact mobile speaker**

More information on the TW-4000A and TS-780 is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

KENWOOD

...pacesetter in amateur radio

All mode "Dual-Bander"

TS-780

2 m & 70 cm all mode, dual digital VFO's, 10 memories, scan, IF shift...

TS-780 FEATURES:

- USB, LSB, CW, FM all mode, covering the 2 m band (144.000-148.000 MHz) and the middle 70 cm band (430.000-440.000 MHz). UP/DOWN band switch.
- Dual digital VFO's with normal/tight drag switch. VFO steps in 20-Hz, 200-Hz, 5-kHz, or 12.5-kHz, plus "FM CH" channelized tuning. Split (cross) frequency operation possible. F. LOCK switch provided.
- 10 memories include band and frequency data, backed up by internal batteries (not supplied). Battery life exceeds one year. Memories 9 and 10 for priority instant recall.
- Band scan, with selectable 0.5, 1, 3, 5, and 10-MHz scan bandwidth.
- Memory scan selectable for all memories, or 2 m or 70 cm only.
- IF shift circuit rejects adjacent interference.
- High sensitivity and wide dynamic range • 7-digit fluorescent tube digital display • 10 watt RF output • 2 m ±600-kHz TX offset switch with reverse switch • Tone switch for optional TU-4C two frequency tone encoder unit • VOX and semi break-in CW built-in • FM center-tune meter • Noise blanker for SSB, CW.

Subject to FCC approval

Bill Pasternak WA6ITF
28197 Robin
Saugus CA 91350

"10...9...8..."

Be ready when the Space Shuttle Columbia *carries aloft the first astro-ham. Here's the best way to contact this historic DXpedition.*

Alan Kaul W6RCL probably said it best about a year ago when he wrote, "Get ready for the greatest DXpedition ever. An astro-ham in space on 2 meters." Alan, who produces NBC Nightly News for the west coast, did not pen those words for that vehicle. Rather, they were the lead-in to a 2-minute special report by Roy Neal K6DUE which aired on my Westlink Radio News Service.

It was a story that took the world of amateur radio by storm, and one which will hopefully unfold on September 30, 1983. That is the day when NASA plans to launch the STS-9 shuttle mission into orbit. On board the orbiter *Columbia* will be the European Space Agency's "Spacelab," manned by an international crew including Dr. Owen Garriott of the United States.

It is Dr. Garriott, the radio he will take with him, and the type of operation planned that will open a new chapter in space-to-Earth communications. Dr. Garriott is a ham—W5LFL. The radio is for the 2-meter amateur band, operates on FM voice, and with it W5LFL hopes to contact amateurs around the world, making this the first time any form of private radio has been used from space.

Background

If you think it's easy to convince NASA to let you operate an amateur station from one of their space vehicles, then try to get yourself permission to do so. In the case of W5LFL/Space Mobile, it has taken a decade and a half. The idea originated shortly before Dr. Garriott was rocketed into space to serve duty on *Skylab*. He had approached NASA with the idea of taking along a 2-meter radio back then, but it was nixed because of power requirements and other technical considerations.

Since that time, the thought of operating from space has stayed with Dr. Garriott, and several years ago with the assistance of members of the Space Center ARC in Houston (W5RRR) and NBC news correspondent Roy Neal, another proposal to carry amateur radio on a shuttle mission was made. The flight would be the STS-9 using the orbiter *Columbia* and carrying the ESA Spacelab. This time the response was positive, with General James Abramson giving the project the green light earlier this year.

About three years ago, two other amateur radio organizations, the ARRL and AMSAT, were brought into the planning of this event. As plans progressed, it was recognized that for the operation to be successful, it would take the full cooperation of amateurs around the world. A radio that could meet the critical requirements of the space shuttle was needed. Specific operating protocol had to be developed to ensure a maximum number of QSOs to be held in the allotted operating time periods. Publicity had to be planned. A QSL manager or bureau would be needed to handle the expected torrent of requests for commemorative cards, and much, much more.

It was obvious that only an organization with the resources of the ARRL could handle such a chore, besides which Dr. Garriott wanted due credit given to the League for its assistance in getting the groundwork for the mission put together. The ARRL has been unofficially involved since the beginning. From the outset, this has been billed as a joint ARRL and AMSAT goodwill operation in celebration of the 1983 World Communications Year, but to us on the ground hoping for a contact with W5LFL from space, it is far more than that.

The STS-9 Radio Equipment

There have been many questions asked about the type of gear that W5LFL will be using on the STS-9. It seems that every amateur has heard a rumor that it will be this HT or that one. Officially, the radio is described as a black-box transceiver supplied by the ARRL. But the ARRL is not building the unit. Rather, its design and construction were placed on open bid to interested radio-equipment manufacturers. About six, both domestic and foreign, initially showed interest.

That number dropped off a bit after the specifications for the unit were announced by NASA. The criteria for the radio are very stringent and include the provision that the equipment cause

CES INTRODUCES THE NEW 510SA "SMART PATCH"

The State of the Art Simplex Interconnect

Communications Electronics Specialties introduces the CES 510SA "Smart" Simplex Autopatch, with many important new features never available before: • Three digit control codes with user programming. • A sophisticated toll restrict provides positive long distance lock out. • Time-out and COR activity timers with warning beeps and digital programming. • Rotary or DTMF dialing. • Phone line in-use detector prevents interrupting a call in progress, and sends unique CW sequence. • Phone ring detection logic enables unique CW sequence. • Digital programming of the sample rate and width, and noise gate sensitivity control, for easy interfacing with most radios. Simple and direct connections to radio.

Options available: • Smart CW identifier with unique CW messages for each patch function. • FCC type accepted phone line coupler. • Special tone squelch kit to operate patch through repeaters.

CES

The 510SA—the newest advance in interconnect technology, from the innovators at:
Communications Electronics Specialties, Inc.
Post Office Box 507 • Winter Park, Florida 32790
(305) 645-0474 • Toll-free (for orders only): (800) 327-9956 462

absolutely zero interference to any other system on board while operating from the indoor antenna. The unit must be totally independent of the spacecraft's electrical system, yet be capable of producing at least 5 Watts continuous power for the duration of each operating period of 1 hour per day for 5 days. In addition, the unit has to be channelized to make it easy for Dr. Garriott to operate, with maximum receiving and transmitting efficiency from 144.9 to 145.8 MHz. All of this and more for the distinct pleasure of knowing that your radio has been selected to be the first in space and never really being able to prove it.

It was decided a long time ago that the term "black box" would be applied to the set by the ARRL, since it didn't want to find itself in the *de facto* position of endorsing the product of one manufacturer over another. Oh, we will all eventually know whose radio flew on STS-9. You can be sure that the manufacturer selected will take full-page ads in every amateur magazine to proclaim this, but you won't see an official endorsement from the ARRL, AMSAT, or anyone else in amateur radio directly involved in the mission. For the sake of objectivity and nonpartisanship, it has to be this way. The leaders of the amateur-radio community don't want to become involved in a "Tang" type of publicity campaign.

The unit itself will have three modes of operation. This is subject to change before this article goes to press, but this is what we have at this writing. Mode 1 will permit split-frequency transceive with Dr. Garriott transmitting between 145.51 and 145.77 MHz and listening for callers 600 kHz lower. It is not expected that this mode or mode 2, which is simplex operation from 145.51 to 145.77 MHz, will see much use (if any) during the mission. Rather, it is mode 3 that will probably be exercised the most. In this mode, the transceiver must be capable of transmitting on the same frequency range of 145.51 to 145.77 MHz, but will receive on an odd offset between 144.91 MHz and 145.49 MHz. Modes 1 and 3 will use 20-kHz inter-channel spacing, as will the channels for the simplex mode 2. More on this operation later.

The antenna will be inside the *Columbia* orbiter itself and will be an "indoor array" of some type affixed to the upper crew compartment window. Several types of antennas are being experimented with. One is a loop, another a printed-circuit resonator, and there are others. Development is taking place at the Johnson Space Flight Center and being done by NASA scientists and engineers. During the flight, *Columbia* will be flying upside down by Earth perspective and that window will be facing the ground.

What the QSOs Will Sound Like

Present estimates are that Dr. Garriott will have time for only about 500 or so QSOs while in space, so don't expect to be able to rag-chew or even speak directly with W5LFL. I hate to use the term, but what I am about to describe is going to sound like some sort of a DX list operation, with Dr. Garriott developing the list as he goes. The STS-9 orbiter, because of its sharp equatorial crossing angle (N to S, S to N), will place W5LFL in direct contact with a given geographic area for about 8 minutes on any given pass. *Columbia* will be traveling with a forward momentum of about 17,000 mph at about 160 miles altitude in what amounts to a sine-

See List of Advertisers on page 114

wave pattern around the planet.

Keeping this in mind, and adding to it that during any given operating period the spacecraft will almost go full circle around the world, you can easily understand the constraints on individual QSO time. For this reason, split-frequency operation and some form of time-sharing between astronaut and terrestrial stations had to be established. When an operating period begins, you will hear W5LFL making a call-up that may be something like this:

"This is W5LFL . . . Dr. Garriott aboard the US Space Shuttle *Columbia* . . . we are now approaching the west coast of the United States . . . I'll be taking calls from the 6th call district only for the next minute . . . this is W5LFL standing by."

For the next 60 seconds, Dr. Garriott will scan across his preprogrammed receive frequencies. During that time, ground stations (that's you and me) will simply choose what we feel is the best frequency for our use and transmit our callsign for one minute. During the next minute, Dr. Garriott will acknowledge the callsigns he hears and then announce the next zone he will be listening for. At this point, the whole process begins again and continues on a minute-by-minute basis until that particular hour's operating period has ended.

As planned now, Dr. Garriott will transmit on the even minutes starting at the top of the hour and will listen for calls on the odd minutes. Stations on the ground will have about a dozen uplink channels to choose from. Use of repeaters and remote-base systems is discouraged, and while some uplink channels may fall on known repeater output channels in the United States, a myriad of stations on the ground trying to capture a repeater to be heard above the throng will make a given channel useless. Therefore, repeater owners on affected frequencies might be wise to terminate the operation of their systems for the 10 minutes or so that *Columbia* will be within radio range each day.

The channels selected for uplink were determined based on international spectrum utilization including ITU regions 1, 2, and 3. Dr. Garriott will not limit his contacts to US hams, but will acknowledge calls from the world over as he passes overhead. While this choice of frequencies may pose a bit of an inconvenience in some major metropolitan US cities where repeaters operate every 20 kHz in the lower subband, it is a choice compatible with the rest of the world. Now you can begin to imagine why groups the size of the ARRL and AMSAT had to be employed to coordinate the ground side of the operation. No one person could possibly do it by himself.

Your Station

Not every ham reading this will have a chance to contact W5LFL/Space Mobile. About 500 of you will be the lucky ones, but it will take more than a 1-Watt HT and a rubber duckie to get through. Stations that are equipped for the OSCAR series of amateur satellites and have the necessary expertise in making contacts through these birds will definitely have the upper hand.

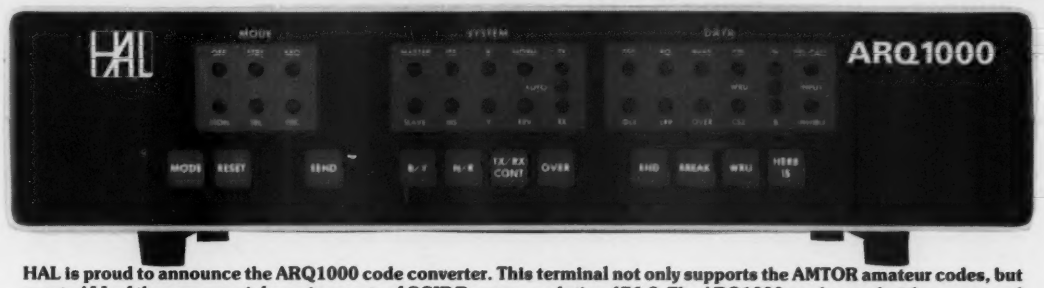
If you do not have this expertise, then you are advised to steer clear of highly directional antenna arrays with small beamwidth. At 17,000-mph forward momentum, the STS-9 will not be in any one spot very long. In fact, unless your station is operating with the antenna under direct computer control with auto-tracking for both azimuth and elevation, any

THE RTTY ANSWER

THINKING OF RTTY??
APPLE . . . TRS . . . HEATH . . . DEDICATED SYSTEM? SOFTWARE? INTERFACE? PERFORMANCE? PRICE? We know you have questions . . . check our answers. Call today for information on our terminal units!

IRL™
700 TAYLOR RD.
COLUMBUS, OHIO 43230
(614) 864-2464
VISA OR MASTER CHARGE ACCEPTED
IMMEDIATE DELIVERY

AMTOR RTTY



HAL is proud to announce the ARQ1000 code converter. This terminal not only supports the AMTOR amateur codes, but meets ALL of the commercial requirements of CCIR Recommendation 476-2. The ARQ1000 can be used with present and previous generation HAL RTTY products. In fact, any Baudot or ASCII full duplex terminal at data rates from 45 to 300 baud may be used with the ARQ1000. Some of the outstanding features of the ARQ1000 are:

- Send/receive error-free ARQ, FEC, and SEL-FEC modes
- Automatic listen mode for ARQ, FEC, and SEL-FEC
- Meets commercial requirements of CCIR 476-2
- By-pass mode for normal RTTY without changing cables
- Programmable ARQ access code, SEL-CAL code and WRU
- Programmable codes stored in non-volatile EEPROM
- Keyboard control of normal send/receive functions
- 30 Front panel indicators and 11 control switches
- Interfacing for loop, RS232, or TTL I/O
- "Handshaking" control for printer and keyboard or tape
- Self-contained with 120/240V, 50/60 Hz power supply
- Cabinet matches style and size of HAL CT2200
- Table or rack mounting
- Built-in M1700 modem option available
- Encryption option available for commercial users
- 3½" × 17" × 10½"

The ARQ1000 is commercial-quality equipment that will give you the outstanding performance you expect from a HAL product. Write for full details and specifications of the ARQ1000.

BY POPULAR REQUEST

By popular request – the new CT2200. Our slogan is "When Our Customers Talk, We Listen" – and we have been listening. The CT2200 includes these often requested features:

- New AMTOR connections for use with ARQ1000
- Keyboard programming of all 8 "brag-tape" messages
- Programmable selective call code
- Expanded HERE IS storage for a total of 88 characters
- Non-volatile storage of HERE IS, "brag-tape," and SEL-CAL code
- 3⅞" × 17" × 10½"

All of the proven CT2100 features are retained. Some of these features are:
• Tuning scope outputs (a MUST for AMTOR) • Built-in demodulator for high tones, low tones, "103", or "202" modem tones • 36 or 72 character display lines • 2 pages of 72 character lines or 4 pages of 36 character lines • Split screen or full screen display • Baudot or ASCII, 45 to 1200 baud • Full or half duplex • Morse code send/receive at 5 to 99 wpm • Send/receive loop connection • Automatic transmit/receive control (KOS) • Audio, RS232C, or Loop I/O • On-screen tuning and status indicators • Clearly labeled front panel switches, not obscure keyboard key combinations • Separate convenient lap-size keyboard • Internal 120/240, 50/60 Hz power supply • Attractive shielded metal cabinet

In addition, an update kit is available so that all CT2100 owners can update their CT2100's to include CT2200 features. The kit even includes a new CT2200 front panel! Rather than making a proven product obsolete, HAL put even more behind the buttons. Pick up a CT2200 at your favorite HAL dealer and join the RTTY fun. Write for our full RTTY catalog.

HAL COMMUNICATIONS CORP.
Box 365
Urbana, IL 61801 (217) 367-7373 TWX 910-245-0784

345

sort of directional array will be a definite handicap.

AMSAT suggests that a horizontally-polarized turnstile-type antenna will probably provide the average amateur the best chance of making a contact. In lieu of this, any good-quality vertical antenna should suffice. The ARRL's *Radio Amateur's Handbook* should be consulted on design of a turnstile, since none for the amateur 2-meter band is currently marketed.

The recommended transmit-output power level is 10 Watts. Running higher power will only cause unnecessary interference to other ground stations and will gain you little. Remember, as with any DXpedition, Dr. Garriott—not you—is in charge of the operation. If there is too much QRM on a given channel because it is infested by the high-power boys, it easily can be bypassed. Dr. Garriott will only spend a few seconds monitoring any given uplink channel. And while we cannot stop anyone from running an amplifier, it is requested by all parties involved in the planning that this practice be avoided.

Because of the odd split between uplink and downlink, you will need a transceiver with split memory so that you can select your transmit frequency independently of the receive frequency. In lieu of this, two radios can be used, one for uplink and the other for receiving the downlink. Even an HT with a ¼-wavelength antenna may suffice for the latter, since Dr. Garriott will be easy to hear from almost 200 miles overhead. If you have an older, crystal-controlled radio sitting in the closet, it might be used for receiving by feeding a stable vfo signal of the proper frequency into the receiver's L/O chain. Designs have appeared in this magazine and elsewhere that might be readily adapted for the purpose. The receiver will then have to be realigned for maximum sensitivity in the region from 145.0 to 145.6. Again, super sensitivity of ground stations is not essential, since W5LFL won't be hard to hear.

So, then, in review: You will need a station running 10 Watts or so of FM on 2 meters with 20-kHz incrementation in the 144.91-145.49 band to uplink to Dr. Garriott. You will have to be able to listen for him on 1 or 2 frequencies in 20-kHz steps from 145.51 to 145.77 MHz. You should avoid highly directional antennas unless you are skilled in their use for satellite-communications purposes, and you should avoid the use of high power to make life easier for both W5LFL and the other ground stations who will be vying for contacts. Omnidirectional antennas in general, and the turnstile in particular, are recommended.

As the plans for Dr. Garriott's historic mission move forward, there will doubtless be many changes taking place. For example, the exact list of frequencies for you to use may not be known until just prior to liftoff. His daily operating schedule, which begins on the third day of the mission, will not be publicized until the vehicle is safely in orbit. It will be announced, hopefully a day before but possibly only hours before an operating period begins. Each operating period is subject to last-minute cancellation with little or no notice should some more urgent activity concerning the overall STS-9 mission itself come up.

While we in amateur radio probably consider W5LFL/Space Mobile as being very important, to the folks at NASA it is the lowest priority on the mission. We are their guest and no

MISSOURI RADIO CENTER 1-800-821-7323

KENWOOD TS-430S

- All Bands
- General Coverage
- 200 Watts
- Dual VFO's
- 8 Memories

ICOM IC-740

- 1.8 to 30 MHZ
- Super Receiver
- 200 Watts
- Selectable IF/PBT Tuning

YAESU -NEW FT-77

- Extremely Compact
- 200 Watts
- 3.5 to 30 MHZ
- Inexpensive

ANTENNA SALE

CUSHCRAFT		HY-GAIN TOWERS		BUTTERNUT		HY-GAIN	
A-3	$175	HG37SS	$ 649	HF6V	$109	TH5MK2S	$318
A-4	$226	HG52SS	$ 919	KLM		TH7DXS	$378
R-3	$226	HG54HD	$1429	KT34A	$299	TH3MK3S	$218
AV-5	$ 90	HG70HD	$2339	KT34XA	$449	TH3JRS	$158
214-FB	$ 69	HG50MTS	$ 749	144-148LBA	$ 69	TH2MKS	$138
32-19	$ 82					18AVT/WS	$ 94
40-2CD	$260	LARSEN	CALL	AEA	CALL	18HTS	$335
						V2S	$ 37
ANIXTER-MARK						EXPLORER 14	$275
HW-3 TRIBAND MOBILE	$34						

Call "TOLL FREE" For All Antennas & Accessories

2900 N.W. VIVION RD. / KANSAS CITY, MISSOURI 64150 / 816-741-8118 -258

more. If we handle ourselves with the proper decorum, we might be invited back again. If we make fools of ourselves, you can count on never being invited back in the door.

Since timely, up-to-the-minute information will be crucial, the planning of this has been included in the overall scheme. First, there is the AMSAT Launch Information Service Net that covered the successful AMSAT/OSCAR 10 launch on June 16. Readers are advised to keep an ear on their local AMSAT nets for further information on what type of network will be established for the STS-9

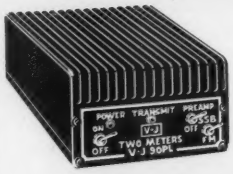
The League's W1AW will carry updates daily, but it is unknown if this will occur at regular times as published in *QST* or at any and all times applicable during the STS-9 mission. This will be announced by the ARRL shortly. Finally, the Westlink Radio Network's automated newsline in Hollywood, (213)-465-5550, will be devoted exclusively to information on the STS-9 mission starting September 1. This will be a weekly tape until September 29; one day prior to the scheduled liftoff of STS-9, it will be updated daily or whenever pertinent information is available. Hopefully, it will carry the day-to-day operating schedule of STS-9. Finally, the *ARRL Letter*, the *W5YI Report*, and *The Westlink Report* newsletters will carry the timely information that can be gathered before presstime.

Amateur magazines such as this, with their longer lead time of about 2 months, cannot bring you up-to-the-minute information on STS-9. We are doing our share by giving you as much background material and technical advice as we can. For up-to-the-minute information, you should consult one of the previously-mentioned news services starting about 10 days before the flight and

See List of Advertisers on page 114

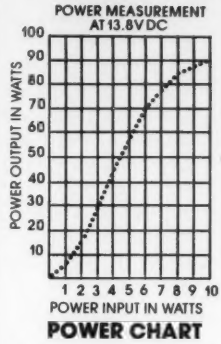
V-J POWER UP

2 METER 90 WATT OUTPUT AMPLIFIER WITH 18 DB GAIN PREAMP



Model 90PL FOR ONLY FACTORY DIRECT $139.95* PLUS SHIPPING

- **FREQUENCY** range 144 - 148 MHz
- **OPERATION FM or SSB** (completely linear) Class AB1
- **RF DRIVE** 1 to 30 watts
- **KEYING RF** activated with high quality relays
- **SSB** operation built in delay
- **POWER REQUIREMENTS** typical 10 watts drive, 13 amps at 13.8 VDC
- **IDLE** current 20 mills
- **MOBILE or FIXED** operation
- **PREAMP** 18DB gain minimum
- **NOISE FIGURE** less than 1.5 DB
- **PREAMP KEYING** independent — separately RF activated relays
- **CONSTRUCTION** wrap around aluminum heat sink 2 pieces 360 degrees cooling
- **SIZE** 7"(w) x 6"(d) x 3"(h) — **WEIGHT** 3 lbs. 9 ozs.
- **IMMEDIATE SHIPMENT**



POWER CHART

SPECIAL OFFER
Matching Power Supply $99.95* PLUS SHIPPING

15 AMP SUPPLY wt. 13 lbs. size 8"(w) x 5"(h) x 6"(d)
IMMEDIATE SHIPMENT
ALL PARTS AND LABOR WARRANTED ONE FULL YEAR

VJ90PL Amplifier $139.95 plus $3.00 shipping
VJ15 POWER Supply $99.95 plus $7.00 shipping
*Prices USA only

VISA, MASTER CHARGE, M.O. or C.O.D. • PHONE (713) 477-0134

V-J PRODUCTS, INC. 505 East Shaw, Pasadena, Texas 77506

SERVING THE ELECTRONICS INDUSTRY SINCE 1965

AVANTI. The on-glass, halfwave, mobile antenna that installs in 15 minutes.

- **Co-inductive coupling** establishes highly tuned circuit through glass with no measurable signal loss.
- **No ground plane:** Full halfwave design—performance equal to practical 5/8 wave installations.
- **DUO-BOND mounting** for firm, fast, waterproof bonding. Removable without damaging car or antenna.
- **No holes:** No vehicle damage; fast, easy cable routing.
- **Four models** for 2 meter, 220 MHz and UHF amateur bands.

the antenna specialists co.

63

a member of **The Allen Group Inc.**
12435 Euclid Avenue, Cleveland, Ohio 44106
Export 55 Main St., Freeport, N.Y. 11520
Canada: A. C. Simmonds & Sons, Ltd.

we design solutions.

staying with it until the mission terminates.

Public Relations

The public relations of this first "Ham in Space DX-pedition" have not been overlooked. As Steve Mendelsohn WA2DHF of CBS in New York has aptly pointed out, this will be one of the very few times when amateur radio will be in the news as the main event, not just the carrier of the message. For the duration of the STS-9/Spacelab mission, the eyes of the non-amateur world will be on us, in sharp focus and high-contrast living color, knowing the way that modern television journalism works.

To help plan for this, two teleconference meetings have been held. They were sponsored by the ARRL and hosted by Peter O'Dell KB1N of the ARRL Public Information Office. The first of these was a briefing primarily for members of the national/international press corps and included representatives of CBS radio and television news, NBC radio and television news, UPI, AMSAT, *The Westlink Report*, and the *W5YI Report*. After this session, another was held for the amateur-radio media and included participation of every major amateur publication and news service. Other such meetings are planned, including the possibility of a group interview with Dr. Garriott prior to the mission, if NASA gives the go-ahead for it.

Radio, television, and printed-media coverage of the amateur-radio aspect of the STS-9 mission is expected to be extensive. Pool video of part of the operation is expected to be supplied to the networks, so it's remotely possible that you might see your own contact being made on your own television screen. More likely, this video will be integrated into scheduled news programs on a tape-delayed basis, intercut with pictures of local hams trying to make the contact. Don't be too surprised to get a call from a local TV station asking if they can send over a crew to tape you making the attempt. A press kit to cover this and any other eventuality is being prepared by the ARRL for field distribution through its field organization structure. This writer and many others are contributors to it, and it will be very detailed on how you should handle this eventuality or any similar one that may occur. Contact your local ARRL Public Information Assistant or Division Director for more details.

Finally, the ARRL is sponsoring the production of a new videotaped presentation entitled "Amateur Radio's Newest Frontier." It will detail the flight of STS-9, amateur radio's involvement in it, and the way in which our service performs a marriage between computer technology and space-age communications. Its producers are Roy Neal K6DUE and this writer; it will be taped in early July on location at the Johnson Space Flight Center, Marshall Space Flight Center, Kennedy Space Center, AMSAT's laboratory, and ARRL Headquarters. Editing will be done at CBS Television City in Hollywood with initial release anticipated around September 1 directly through the ARRL.

The hope is to have the tape in every school in the United States prior to the STS-9 liftoff. On termination of the STS-9/Spacelab mission, the master tape (1" type C for those interested) will be re-edited using actual NASA footage of Dr. Garriott operating from the *Columbia* and a second release will be made.

Also, the presentation will

RC-850 REPEATER CONTROLLER

A Breed Apart!

The **RC-850** Repeater Controller is creating a New Breed of repeaters. Providing the ultimate in reliable, versatile communication, with the most advanced repeater autopatch available, and synthesized linking to other repeaters.

Its mailbox, informative ID and tail messages, and user signal diagnostics make it your group's "Information Center".

Plus two-tone paging, site alarms, and remote control functions.With remote metering to let you troubleshoot your system from home. Its built-in time of day clock and Scheduler have redefined the meaning of "automatic" control.

The **RC-850** controller is remotely programmable with Touch-Tone commands, and is available with life-like synthesized speech for an ideal human interface. And it's upgradable through software so it'll never become obsolete.

Communication, information, signalling, control. The New Breed . . .

MAKE YOUR REPEATER A WHOLE NEW ANIMAL WITH THE RC-850 REPEATER CONTROLLER

Call or write for detailed specifications on the RC-850 Repeater Controller.

acc advanced computer controls, inc.

124

10816 Northridge Square • Cupertino, CA 95014 • (408) 749-8330

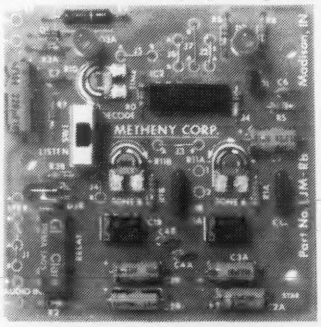
$15 DTMF DECODER $15

The LJM2RK decoder kit converts your receiver into a special receiver or control. When a user-selected time-tone combination is received, the output provides a relay control for activating speakers or other devices.

INPUT: Audio from transceiver, scanner, etc.
OUTPUT: SPST (N.O.) relay.

FEATURES: Single or dual tones adjustable over the 16 digit Touch Tone range • Adjustable response time • Relay output • Manual or auto reset • Single tone ON latching with different single tone reset OFF • Operates on 12VDC • Interfacing of multiple boards for multi-digit sequential activation and reset.

APPLICATIONS: Call-up system • Repeater or commercial controls • Etc. limited only to your imagination •



Actual Size 3"x3" - Shown Assembled

LJM2RK decoder kit includes all component, relay, and P.C. Board. . . . $15 plus $1.50 shipping.

LJM2RC enclosure kit includes molded case, speaker, input cable. . . .$5 plus $1.50 shipping.

For information and to order write:

THE METHENY CORPORATION
204 Sunrise Drive, Madison, IN 47250

205

be made available to television stations interested in airing it prior to or during the mission. Its running time will be between 10 and 15 minutes, with availability on the following tape types: Broadcast 1" type C, Broadcast 2" Quadraplex, 3/4" U-Matic, VHS-SP Speed, and Beta II.

The tape will be recorded using the NTSC 525-line standard, but both PAL and SECAM dubs will probably be made available at additional cost.

Again, contact the ARRL directly or through your Division Director for availability of this tape. Initial copies will be distributed on both U-Matic and VHS to all directors as soon as the project is completed. Please do not bother them prior to early September, since I know that it won't be finished until around that time.

Summary

Barring the unexpected, such as a delay in the STS-9/Spacelab mission itself, the US Space Shuttle *Columbia* carrying the ESA Spacelab will be launched into orbit from the NASA facilities in Florida on September 30. Sometime on October 2, at an exact time to be announced, the amateur-radio aspect of the mission should begin. Dr. Garriott will be operating as W5LFL, either Portable *Columbia* or Space Mobile. He will operate for one hour per day in the frequency span discussed earlier. Ground acquisition from any given geographic location will be about 8 minutes per pass. It is estimated that Dr. Garriott will be able to make about 500 contacts during the mission.

Finally, there is the all-important QSL information. ARRL Headquarters will be the QSL manager for the operating event. Since, as stated, only about 500 of you will make that lucky contact, a decision has been made to honor SWL reports that can be verified against operating times contained in both the written and voice-recorded logs. A system has been developed to prevent dual contacts while at the same time make legitimate QSLs for contacts made with STS-9 easy to prove. However, this also means that anyone, ham and non-ham alike, who sends a verifiable report to ARRL Headquarters will be eligible to receive a commemorative card in return.

This information is already being widely disseminated by SWL programs on many international shortwave stations and will probably be reported by the US mass media during the flight. The ARRL staff may be burning the midnight oil on this one for many days to answer all of the QSL requests.

There, then, is the story of what to expect on the STS-9/Spacelab mission. Again, I have to stress that much of this is subject to change with little notice. The best way to keep up to date is by turning to one of the daily, weekly, or bi-weekly amateur-radio news operations mentioned earlier. During the mission itself, one of the amateur-radio broadcast services supplied by the ARRL, AMSAT, or Westlink will be your best source of information since they can literally update at a moment's notice. In the meantime, we trust that many of you will enjoy the aspect of getting prepared to try to contact Astronaut/Dr. Owen Garriott W5LFL on 2-meter FM as he spins around the world. Whether you make the contact or not, getting ready for the event will be half the fun. Hearing W5LFL from space and knowing that he is one of ours will be the other half. Making a contact is literally the frosting on the cake. ■

COMPLETE READY-TO-USE SYSTEMS

ATV TRANSMITTER/CONVERTER

$399

TC-1

★ **High resolution and color video**
★ **10 watts output**
★ **Broadcast standard sound**
★ **Tunable downconverter and preamp**

Connect to the antenna terminals of any TV set, add a good 450 MHz antenna, a camera and there you are . . . Show the shack, home movies, computer games, video tapes, etc.

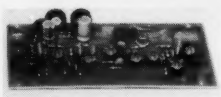
ATV DOWNCONVERTER

For those who want to see the ATV action before they commit to a complete station, the TVC-4 is for you. Great for public service setups, demos, and getting a buddy interested. Just add an antenna and a TV set tuned to CH. 2, 3, or 4 and plug in to 117 volts a.c. **$89.00**

TVC-4

TVC-4L extra low-noise version . . . $105 . . $99 delivered in USA

MODULES



TXA5-4 Exciter/Modulator . $90 . $85.00 ppd.
Wired and tested module designed to drive PA5 10 watt linear amplifier. The 100 MHz crystal design keeps harmonics out of two meters for talk back. Video modulator is a full 8 MHz for computer graphics and color. Requires 13.8 VDC reg. @ 70 ma. 80 mw output power. Tuned with crystal on 439.25, 434 or 426.25 MHz.
Dual frequency model available . $115 . . $110.00 ppd.

TVC-2 ATV Downconverter . $65. . $45.00 ppd.
Stripline MRF 901 preamp and double balanced mixer digs out the weak ones and resists intermod and overload. Connects between UHF antenna and TV set. Output channels 2 or 3. Varicap tuner 420 to 450 MHz. Requires 12 to 18 VDC @ 20 ma.
Extrasensitive TVC 2L with bipolar preamp (.9 dB NF) . . . . . $69 . . . . . $59.00 ppd.
Supersensitive TVC 2G with GaAs Fet preamp (.5 dB NF) ant. mount . . . . . $79.00 ppd.

FMA5 Audio Subcarrier Generator . $29.00 ppd.
Puts audio on your camera video just as broadcast does at 4.5 MHz. Puts out 1 V p-p to drive TXA5. Requires low Z mike, 150 to 600 Ω and 12 to 18 VDC @ 25 ma. Works with any transmitter with 5 MHz video bandwidth.

PA5 10 Watt ATV Power Amplifier . $89.00 ppd.
The PA5 will put out 10 watts RMS power on sync tips when driven with 80 mw by the TXA5 exciter. 50 ohms in and out plus bandwidth for the whole band with good linearity for color and sound. Requires 13.8 VDC reg. @ 3 amps.

Let P.C. put you on the air and SAVE!
All four modules —
Complete System price $235.00
SAVE $27.00 over price if purchased individually

Call or write for our complete catalog of specifications, station setup diagrams, and optional accessories which include: antennas, modulators, test generators, cameras and much, much more. See Ch. 14 1983 ARRL Handbook.

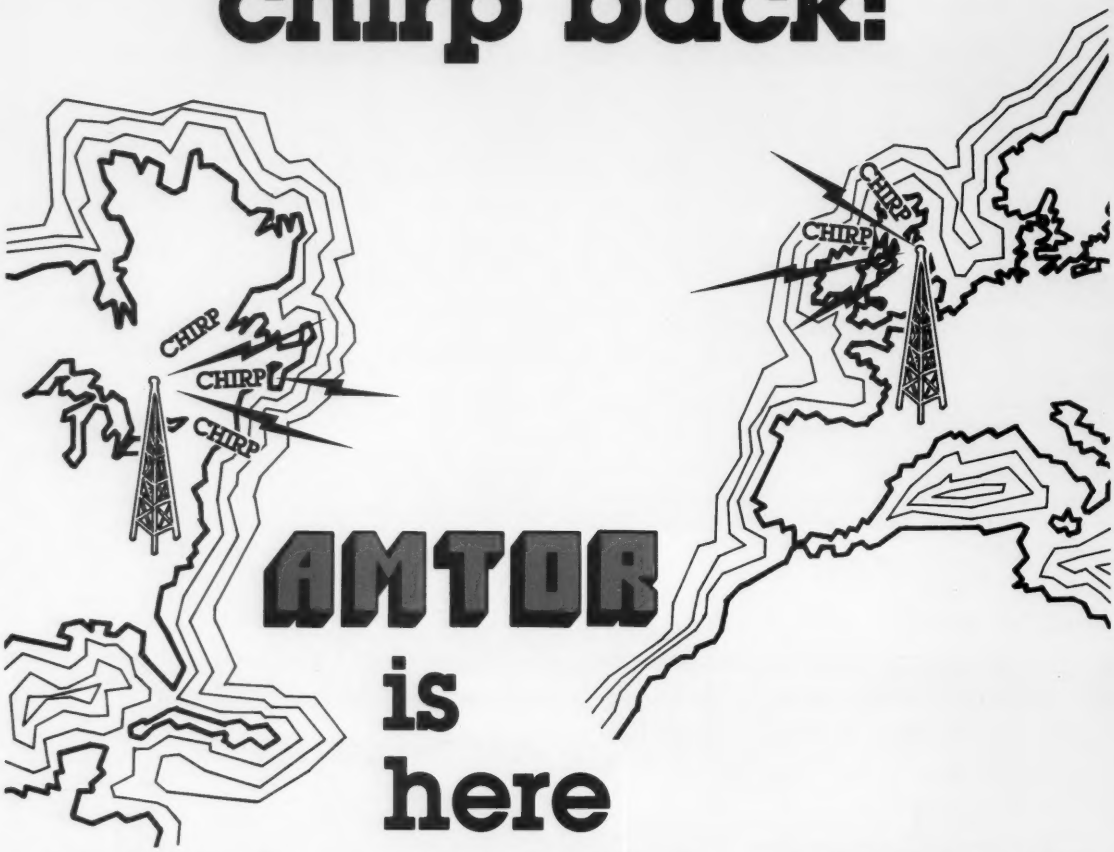
TERMS: VISA or MASTERCARD by telephone or mail, or check or money order by mail. All prices are delivered in USA. Charge orders normally shipped within 24 hours. Personal checks must clear first.

(213) 447-4565

P.C. ELECTRONICS 2522 Paxson Lane
Tom W6ORG Maryann WB6YSS Arcadia, California 91006

See List of Advertisers on page 114

Now you can chirp back!



AMTOR is here

Been wondering what those "chirp-chirp" signals were around 14075? They're AMTOR, AMateur Teleprinting Over Radio. European hams have been enjoying the benefits of error free RTTY for sometime. (It's a must for commercial Maritime traffic.) Now, U.S. Amateurs are on the threshold of a new era of RTTY.

Old problems of QRM, QRN, & QSB are gone! If a propagation path exists, AMTOR will get the message thru — with no "hits" — "newspaper" perfect copy!

Two modes are available; AMTOR mode A transmits a three character block specially coded so that the receiving station can recognize an error. The three character block is repeated until the receiving station confirms reception by replying with the proper control code signal. Flawless print is possible with this "hand-shake" style operation.

Mode B, "FEC" or Forward Error Correction, is actually a time diversity mode where text is repeated and intermixed in the transmission. The receiving station unscrambles it and prints the clear text. This "broadcast" mode allows more than two stations to communicate. It's more effective than conventional Baudot or ASCII, but not as reliable as AMTOR mode A.

The actual DATA transfer in either AMTOR mode is nominally equivalent to conventional RTTY at 50 baud, or 66 WPM.

A receive only "Listen" mode is also available for reception of mode A data by a station not directly involved in the "hand-shake" communication.

Start with a new AMTOR ACT-1, ATR-6800, or update your present system.

Microlog is ready with AMTOR! Give us a "chirp" at Microlog Corporation, 18713 Mooney Drive, Gaithersburg, MD 20879. TEL (301) 258-8400. TELEX 908153

51

MICROLOG

INNOVATORS IN DIGITAL COMMUNICATION

MEMORY BACK-UP
AND HIGH SPEED PRINTER OUTPUT*

Never Lose Your Memory Again!

All "Here-is" memories, ID's **and** all keyboard input parameters are retained for 2 weeks by the internal Ni-Cad battery & charging circuit. Load up the memories, carry the ACT-1 out to your field-day site and be ready to go as if you never turned it off! Also included in this option package is the high speed code converted RS-232 serial printer output.

The best gets better at MICROLOG Corp.
18713 Mooney Dr., Gaithersburg, MD 20879
Tel. 301-258-8400 TELEX 908153.

MICROLOG 51

INNOVATORS IN DIGITAL COMMUNICATION

• SIMPLE DIRECT CONNECTION to your Transceiver. • COMPLETE SYSTEM, built-in Demodulator & AFSK Modulator with keyboard programmable tone pairs from 500 to 3000 Hz. • SPLIT-SCREEN operation with keyboard selectable line location • 1400 character text buffer. • TEN, 40 CHAR. programmable message memories (doubles with BATT. BACKUP), plus ID's WRU & SELCALs. • RANDOM CODE generator & hand key input for practice. • Baudot 60 to 132 WPM. • ASCII 110 & 300 baud. • SYNC-LOC MODE for improved ASCII operation. • RECORDER INTERFACE for "BRAG-TAPE" or recording off-the-air. • CODE CONVERTED printer output in Baudot or ASCII. • SSTV/GRAPHICS transmit. • FULL 63 KEY Computer grade keyboard.

NOW AVAILABLE

*9" monitor $199. Battery Backup & RS232 print $125.

HF TRANSCEIVER

JST-100

JRC Japan Radio Co., Ltd.

JAPAN RADIO CO. the leader in worldwide marine and electronic equipment for over 65 years presents the incomparable JST-100 H.F. Transceiver for the Amateur market.

Highest quality available

— Features of Interest —

- Digital Two-VFO System
- 10 Hz Resolution
- 11 - Channel Memory
- Unique ALC Input
- Over Modulation Indicator
- Modular Plug-in Boards
- Speech Processor
- Up-Down Tune Buttons
- Remote Control of Frequency and Mode

The JST-100 is a new all mode transceiver which incorporates the most advanced radio technology. It employs an 8 Bit Microprocessor to control all of the sophisticated functions. The 11-channel memory can store and recall VFO frequencies, as well as working frequency bands and modes. The unit features three PLL circuits with a highly stable 10MHz standard crystal oscillator. The ALC is unique in that it will take either a positive or negative voltage input. No need to be concerned whether or not your amplifier has the correct voltage polarity. Frequency Data Output including Bands is available in TTL form from the connector on the rear panel. This can be used for automatic antenna switching, external frequency display or output to a microcomputer. The digital two-VFO system is controlled in 10Hz steps by a microprocessor, permitting independent selection of frequency bands and modes, an unlimited difference between two VFO frequencies and instantaneous frequency switching. Further, this two-VFO system allows simple cross-mode operation on a same frequency for transmission and reception and split frequency operation within the same band in the same mode of emission, ensuring efficient communication in a pile-up condition and effective communication even in case of different interference frequencies at both station sites.

SPECIFICATIONS

Frequency Range:	1.8-2.0 MHz, 3.5-4.0 MHz, 7.0-7.3 MHz, 10.1-10.15 MHz, 14.0-14.350 MHz, 18.068-18.168 MHz* 21.0-21.45 MHz, 24.89-24.99 MHz*, 28.0-29.7 MHz *Receive only
MODES:	A1, A3J, F1 (RTTY) 170 Hz shift
Frequency Increment	- 10 Hz. steps.
Power Supply Requirement:	13.8 VDC, 2A. receive 20 A. transmit
Power Output:	100 W.
Carrier Suppression:	50 db or more
Undesired Sideband Suppression:	60 db or more
Frequency Stability:	Within ± 10 ppm for 5 - 60 min. after power on. Within ± 2 ppm thereafter.
Image & IF Rejection:	each 70 db or more
Optional:	Supply NBD-500 G/U Antenna Tuner NFG-97 Speaker NVA-88 4 ohms Filters 600 and 230 hertz Desk Microphone CHG-43 Hand Microphone CHG-44 Headphones ST-3 Key KY-3A

For further information, contact:

JRC Japan Radio Co., Ltd.

MR. TAD HAYASHI New York Branch Office
120 East 56th Street
New York, N.Y. 10022 Tel. 212-355-1180

Join the Packet-Radio Revolution

Get error-free, high-speed communications. Packet radio's chief architect, WA7GXD, explains what it is and how it works.

Lyle Johnson WA7GXD
c/o Tucson Amateur Packet Radio
PO Box 22888
Tucson AZ 85734

Radio amateurs in Canada, Sweden, and the United States have recently been experimenting with a new system of communications that:

- can provide 100% copy under adverse band conditions (QRN),
- is virtually immune to interference from others on-channel (QRM),
- typically runs at about 1200 wpm (and can go *much* faster),
- is highly efficient of spectrum use,
- "...contribute(s) to the advancement of the radio art" (FCC Rules and Regulations, Part 97.1(b)—Basis and Purpose), and
- is inexpensive (surprise!).

This mode is called packet radio, and it opens the door to a new world of computer-based communications for the amateur community.

Imagine having a QSO with an amateur a continent away via a low-power 2-meter FM rig, or handling emergency traffic without worrying if you correctly copied the spelling of Solzhenitsyn, or leaving a message at a friend's shack if he is out. Then there are possibilities for bulletin-board systems, remote programming of computers, file transfers, and even multi-player computer games! The list of potential applications goes on and on.

This article is written to give the reader a practical look at packet radio, including a description of the equipment needed to use this new communications mode. Subsequent issues of *73* will carry details on hardware, software/protocol, and application. While the reading should prove interesting, the application of packet radio in *your* ham shack is the primary goal.

What Is Packet Radio?

Packet radio is a method of communications that encodes information digitally and in such a manner as to virtually ensure error-free copy at the receiving station. While this is quite a step forward from the present vulnerability of amateur radio operations to such things as QRM and QRN, it is only part of the picture. Packet-radio techniques also provide efficiency in spectrum usage by packing multiple calling and working channels on the same frequency.

If you've ever operated RTTY, you are very aware of the problems of selective fading, static crashes, and so forth—garbled copy is the usual result. The solution to selective fading generally means clever TUs and/or diversity reception, and this usually implies either a great deal of time or money or both. ASCII adherents will no doubt confess that they, too, are subject to the same problems. In fact, many RTTY operators have resisted switching to ASCII for this very reason.

In RTTY operation, operators will typically call a CQ on a calling frequency, then QSY to a working frequency to carry on their QSO so that other RTTYers may use the calling frequency. If a number of stations attempted to hold independent QSOs on the same frequency, chaos would result.

Packet radio overcomes the first of these problems by employing a technique called "handshaking," along with a computed error-detection value called a "Frame Check Sequence" (FCS) to ensure data integrity. The sending station expects an acknowledgment (ACK) to its transmission within a certain period of time or it retransmits. Upon accurate reception of a packet, the receiving station sends this ACK and the sender then continues about its next task. The handshake is done automatically.

Due to the structure of a packet, which contains certain information regarding the destination station, multiple users can be accommodated on a single frequency, holding separate QSOs without causing noticeable interference to each other! This means that the calling and working frequencies may be the same. This ability to selectively receive messages

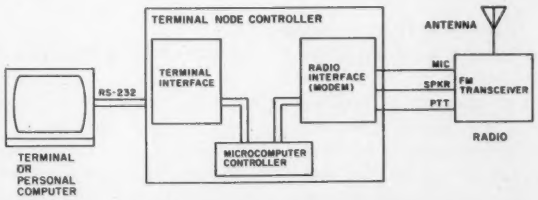


Fig. 1. Typical packet-radio equipment.

from a packet station on-channel is called "connectivity" and is a major contributor to the efficiency of packet radio.

Packet radio also takes advantage of the fact that most communications are "bursty." This simply means that a user does not require the entire channel bandwidth most of the time. Consider an operator typing a message to another station. It may take him as little as 10 seconds or as long as a minute to type a line, but it takes packet radio less than a second to get that data out. The packet system operates in bursts and leaves the dead time available for other packet stations (time-domain multiplexing). On a lightly-loaded channel (only a few users), you may not even be aware of the other stations! On a heavily-loaded channel, you may notice an increase in delay time before getting your reply back. Again, the packet-radio equipment takes care of all of this for you, automatically.

While packet radio requires the use of a computer-based controller at each station, it does not require that each operator be well-versed in computer technology, nor that the operator be a programmer. In fact, it does not require that the station have a personal computer; just a terminal will do.

Requirements

There are four primary components in an amateur packet-radio station: (1) a licensed amateur radio operator, (2) a user terminal, (3) a Terminal Node Controller (TNC), and (4) an amateur radio station.

Operator—The amateur operator is you! No special training in computer science, electronic engineering, nor digital communications is needed. All that is required is an interest and a little time. Packet radio does not run your station; you run it. (Note that amateurs possessing personal computers and a certain amount of expertise may be able to program their computers to control their packet stations.)

A complete packet-radio station. The TAPR TNC is below the HT.

Terminal—The user terminal can be as straightforward as a simple Cathode-Ray Terminal (CRT), a personal computer, or an ASCII-speaking TTY, or it may be as complex as a commercial computer installation. A keyboard should be available for the operator to enter messages and to control the station. A screen or printer should be available to present information to the operator. No doubt, some packeteer will design a speech-synthesizer interface and use a speaker for output! (After all, our radios talk to us now, don't they?)

Most terminals, like RTTY and ASCII systems, encode the characters they send in an asynchronous format. This means, due to the "burstiness" of typing a message, that each character has a little flag to mark starting and ending points. The method employed is to encode a single space before the character and end the character with one or more mark value levels—see Fig. 2. This way, whenever a character is started, a transition from mark to space occurs. This, along with some timing information, makes the data easily decodable. In the case of RTTY, 7½ "bit-times" are used per character, and ASCII uses 10 or 11, depending on the baud rate (note that a baud and a bit are not the same thing, but in amateur use, one bit per baud is encoded, so the terms have become blurred.

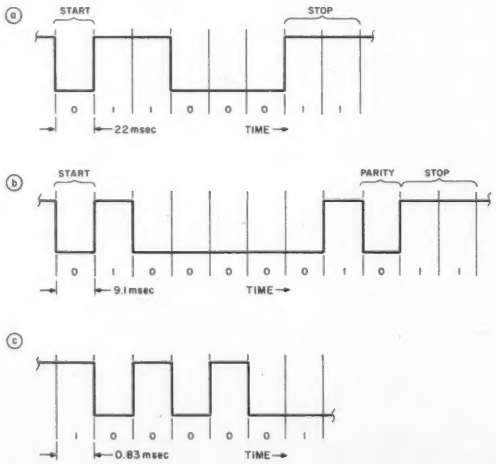


Fig. 2. (a) Typical RTTY (Murray) code for letter "A", 60 wpm. Note that in asynchronous formats, as used by amateurs, each character has one start and one or more stop bits. (b) Typical ASCII code for letter "A", even parity, 110 baud. (c) The ASCII letter "A" within a packet at 1200 baud. Note that a 1 is sent as "no change in state" while a 0 is sent as "a change in state." This is referred to as NRZI (non-return to zero, inverted) coding and is used by virtually all packet stations.

If you have a terminal or computer, you can use it. If not, terminals and computers that use TV sets for the display are readily available for less than $100. Nothing complicated is necessary.

Terminal Node Controller—The TNC is a device which connects the terminal and the radio system together. One port connects to the operator's terminal (or personal computer), communicating via the asynchronous serial or parallel method required by the terminal. (Note that the terminal baud rate has no relationship to the packet-channel baud rate.) The TNC converts the asynchronous data stream from the terminal into packets and vice versa—see Fig. 3.

The header contains an address to indicate where the packet's going and control information telling the network certain details regarding the packet. The FCS calculation ensures the integrity of the data, and flags mark the beginning and end of the packet.

The other port of the TNC is the radio interface, which connects to the microphone audio, PTT, and speaker/phone audio lines. The modulation method most often used in packet radio is AFSK. This simply involves the application of one of two tones

to the microphone input on a voice-grade radio, one tone corresponding to a mark, or digital 1, and the other to a space, or digital 0. By switching between these tones, the data is passed to the radio, which handles it like any other audio signal. The receiving station then decodes the audio tones coming from the speaker or headphone connector on the radio and recovers the data, which is then processed. The advantage to this method is simplicity; the disadvantage is the use of a wider-than-necessary channel.

RTTYers will recognize this method since they have used it for years. They will also recognize the need for a terminal unit (TU), a device used to translate between the logic levels (data) and the tones. In packet radio, the TU is called a "modem" (Modulator-DEModulator) and serves the same function. (Note that some TNCs have the modem built in, while others require the use of an external modem.)

The usual packet-radio modem operates at 1200 baud (about 1200 wpm) and uses tones of 1200 Hz and 2200 Hz. This particular combination of tones is also used in the Bell 202 standard, which allows compatibility with surplus modems. In fact, some of the first packet stations used surplus 202 modems. Note that the tone combination is the only feature needed in a packet-radio modem to ensure compatibility with 202 users. The other aspects of the 202 standard (handshaking, timing, reverse channel, etc.) are not used in the rf environment.

Radio—The radio system can be whatever you have. Most packeteers use a 2-meter FM rig, such as a handheld or even a simple crystal-controlled "hamfest special." In light of the increased channel efficiencies that can be obtained with specially optimized radio design, we can expect to see rigs designed especially for packet radio in the near future.

High-speed transmission is possible with packet radio.

Note that the AFSK tones used in packet radio aren't compatible with the audio-frequency response of some radios: If the 2200-Hz tone is too severely attenuated, minor surgery may be required on the radio itself. With this one limitation, a radio suitable for voice communications can also be used for packet radio. (Duty cycle is not a factor, due to the previously-mentioned burstiness of a packet.)

In addition to the radio, an antenna system and a power supply for the radio are necessary.

Why Use a Terminal Node Controller?

The heart of a packet-radio station, next to the operator, is the TNC. The TNC is actually a special-purpose microcomputer, and it contains the necessary programs (software) to handle the radio, pass information between your station and other packet-radio stations, connect or disconnect your station from other stations, and so forth. These functions and the way they are implemented are part of packet "protocol." While protocol is much more than just the above, the job of the TNC is to effectively implement the protocol.

Many potential packeteers ask why a TNC is needed if they already have a personal-computer system. It doesn't appear too efficient in terms of dollars, at least at first glance. Indeed, there are some stations using packets that have modified their personal computers to act as TNCs, with varying degrees of success. The problems arise from two primary sources: protocol and real-time programming.

Protocol—Protocol is defined by Webster as "the highly formal procedure in official society." While packet radio is not an official society, it does require very formal, precise, well-defined, and (at least locally) standardized procedures in order to transfer data reliably.

In order for a number of stations to be on one frequency at one time with a variety of transmissions, ACKs, and so forth all going on, a computer network, not unlike a typical amateur net, must be established. This must be done rapidly and—in typical net fashion—according to procedures. If a station fouls up, it can cause a lot of confusion on the net. Stations must be able to check in and out of the net at will. The entire system becomes highly complicated, and the effort required to program the protocol is substantial. To handle these procedures, special hardware is needed, not found on any presently-made personal computers. The TNC is designed to handle all of the physical protocol (radio and terminal interfacing) as well as local networking.

Programming—Most computer hobbyists are familiar with some version of the Basic language and do much, if not all, of their programming in it. Calculation of an OSCAR satellite position, logbook entry, and other typical amateur applications run just fine in Basic. Basic is usually implemented as an interpreter, which slows things down during execution but allows the computer system to be interactive ("user-friendly") during programming sessions. To speed up things that must occur quickly, such as graphics or special I/O, some programs resort to assembly-language routines.

In packet radio, the TNC is required to perform many simultaneous tasks. It must check for activity on the frequency, examine all messages for certain data, accept operator input in the form of messages and commands, output data to the operator, handshake, initiate and respond to control within the network, perform FCC-mandated CW ID at prescribed intervals, ACK to certain transmissions, determine if some other packet-radio station interfered with its transmissions (called collision detection), and so forth. This is enough to keep one microprocessor very busy, especially at high data rates. To also be refreshing a video display, doing disk accesses, and handling general-purpose computing is beyond the ability of most personal-computing systems.

The type of software required to do this multitasking is different than normal software, and it requires a very different approach in design than that required by other types of programs.

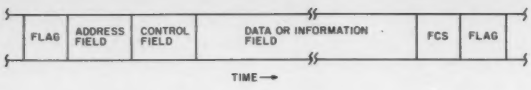


Fig. 3. A typical packet frame. Flag=01111110=1 byte. ADDR=1 to 24 bytes (protocol dependent). CNTL=1 or 2 bytes. DATA = 0 to 128 bytes typical. FCS = 2 bytes. Flag = 01111110 = 1 byte. All bytes are sent least-significant bit (LSB) first except the FCS, which is sent most-significant bit (MSB) first.

Most personal computers are not designed to support this sort of programming, nor to efficiently support the special type of interrupt-driven hardware systems needed to run in this sort of real-time environment.

In many commercial-computing systems, multiple CPUs are employed to speed things up—a technique called multi-processing. A TNC gives the amateur with a personal computer some of the same benefits. While your computer is doing disk I/O, the TNC can be doing what it must do to support the packet-radio activity. The TNC, then, is nothing more than a "smart" peripheral device for your personal computer, much like a disk drive or a printer. It does its task well, allowing your personal computer the time it needs to do its general-purpose tasks well.

What Is a Packet?

Again referring to Webster, a packet is "a small, compact bundle or portion." In packet radio, messages are broken up into small pieces and sent to the receiving station where the pieces are put together to rebuild the message. Naturally, some information is appended to the message so the receiving station will be able to sort things out. On a busy channel, there may be packets flying around between dozens of stations, but only a few are for you.

The operator generally just types in the message he wishes to send. Once the TNC has been told where to send the message, it starts breaking the text into packets which are then sent out on the network. While the size of a packet may vary, most are limited to 128 bytes (or characters, if sending text information) in the data field to allow channel access by multiple users. Typically, when the operator hits the RETURN or ENTER key on his terminal, the TNC formats and sends a packet. Thus, as the operator types the message, the receiving station immediately displays it.

Since packet radio is designed to handle any form of digital data (not just ASCII or Baudot, but also binary, EBCDIC, or whatever), a special method of formatting the data is employed. Most packet systems use a protocol based on High-Level Data-Link Control (HDLC) standards. HDLC is a Bit-Oriented Protocol (BOP) that enables the "transparent" (unmodified) passing of information within the system. One of the nice things about using HDLC is that the complex functions it uses to do its tasks are available integrated on a single large-scale integration (LSI) chip, which reduces the complexity of the TNC hardware and software, as well as TNC cost.

A packet is enclosed in an HDLC *frame*, which may be represented as shown in Fig. 3.

The *flag* is something the HDLC controller looks for (when receiving) or adds (when transmitting) to the packet to mark the beginning of a packet frame. It is a totally unique pattern of 1s and 0s for easy detection.

The *address field* contains information as to where the packet is being sent and possibly who sent it. Some schemes use the amateur callsign in this field (14 or more bytes), while others use a mapping system that requires only 1 or 2 bytes. Don't worry about how packet radio can support different addressing methods and still allow the stations to communicate—this is handled by the protocol and will be explained.

The *control field* tells the network certain things about the packet and includes sequencing, acknowledgment, and other control functions. This field may be one or two bytes in length.

The *data field* contains the actual message being sent. Unless the message is less than one packet in length, multiple packets will be required to send it, due to the current 128-byte data-length limit. The information in the data field is almost always user-provided.

The FCS provides the receiving station (node) with the information it needs to determine whether or not the data is valid. If the FCS calculated by the receiving node doesn't match the FCS it receives from the sending node, the receiving TNC throws away the packet.

The packet is closed by a second flag.

The flags, address field, and control field are all generated by the TNC and are used within the packet-radio network to implement the protocol used. The operator does not need to concern himself with the coding of these fields to use packet radio since the TNC does it all for him.

Since HDLC utilizes flags to mark the beginning and ending points of the entire packet, it is very inefficient to further require that each chararacter also have flags, so packet radio uses a synchronous protocol, removing the start and stop bits. This reduces the length of Baudot characters to only 5 bits and ASCII characters to 7 (parity is redundant due to the FCS). This means greater on-channel throughput.

How Is a Packet Network Organized?

At present, packet radio consists of several unconnected local area nets (LANs) that usually run on 2 meters or 220 MHz. Since this implies local coverage, it is only necessary that a station use the protocol being used in its vicinity. The advantages here are many, including the fact that it allows widespread experimentation with protocol optimization. This in turn leads to more efficient operation and allows each group the freedom to try various approaches for their own unique requirements.

An LAN may include a packet repeater, although using a repeater is not always necessary. The time-sharing nature of packet radio allows using a half-duplex (single-frequency) repeater. No splits or cavities are needed, so any packet-radio station can be a "digi-peater." Having a station act as a digi-peater requires no special effort on the part of the operator, who may continue to use it as a standard packet-radio station. Further, a normal full-duplex, split-frequency repeater could be used.

Naturally, VHF is limited in coverage (no one has successfully had a packet QSO with moonbounce yet), and most packeteers would like to communicate with others in other LANs. To this end, several packet stations are becoming operational on HF, and the unique challenges presented by HF operation are being met. However, another mechanism is being explored, called gateway operation (see Fig. 4).

A gateway station is a good example of shared resources, another packet advantage. To communi-

When two recent American Everest expeditions mounted the Larsen® Külduckie® antenna on their radios, it wasn't just because it was there. It was because they knew Larsen performance and reliability would be there when needed the most—even at the top of the world.

Extreme altitude, sub-zero temperatures and unpredictable conditions demand more than most antennas give in a lifetime. For Larsen Külduckie antennas, it's all in a day's work.

We design our portable antennas to give more than what's expected. Copper plated radiating elements turn power into stronger communications—not heat. Double-soldered connections at maximum stress points allow 180 degree bends in all directions. And not one, but two layers of low dielectric loss, heat-shrinkable tubing protect the element, while a top coat of PVC provides a sleek finish.

You can expect more from our service too. Our prompt delivery, personal attention and no nonsense warranty back you up every step of the way.

So whether you're leading an expedition up the face of Everest, or just hiking through the back country, Larsen Külduckie portable antennas will keep you on top of the situation with peak performance. We'd be glad to show you how they'll work for you.

Write for our free amateur catalog.

LARSEN IS ON TOP OF THE WORLD

A World Of Difference In Performance

Larsen Antennas

↙322

IN USA: Larsen Electronics, Inc./11611 N.E. 50th Ave./P.O. Box 1799/Vancouver, WA 98668/206-573-2722
Telex 152-813 LARSEN ELC VANC

IN CANADA: Canadian Larsen Electronics, Ltd./283 E. 11th Ave., Unit 101/Vancouver, B.C. V5T 2C4/604-872-8517 Telex 04-54666 CDN LARSEN VCR

Larsen®, Külrod® and Külduckie® are registered trademarks of Larsen Electronics, Inc.

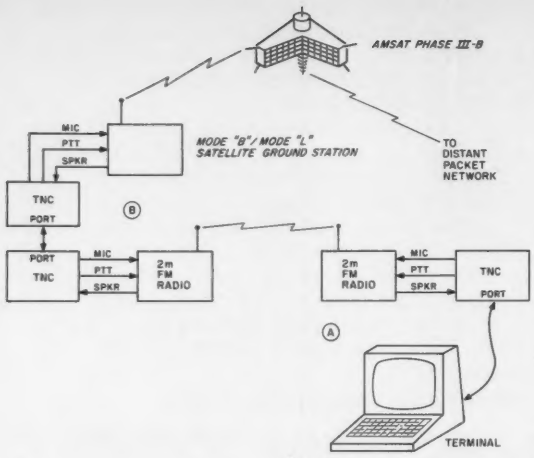


Fig. 4. Typical packet gateway system. Station A uses a simple 2-meter HT. Station B provides linking to other packet networks via satellite. Similarly, an HF link could be established.

cate outside the LAN, a gateway station receives the packet and does a "link" via a gateway channel and with another protocol (actually another layer of protocol). It translates the LAN protocol into the protocol used by the inter-network linking system. The gateway at the receiving end retranslates the protocol into its LAN protocol. Due to the continuing experimentation that is being conducted within packet radio, it is likely that the gateway system will be used for a long time.

Gateway stations allow the user in an LAN to communicate with other packet-radio stations far beyond his normal range. To allow this, three primary gateway paths are being developed:

TERRACON will be a high-speed UHF and/or microwave-based linking system that will form a so-called backbone network. This will enable any packet station to communicate with any other packet station that is also linked into TERRACON. This system could handle the bulk of long-distance packet-radio communications in North America, and it may find its way into other high-population areas such as Europe. Packet groups are working on this development; it will probably be a few years before a useful system is implemented, and a few more years before it links the continent.

AMICON is AMSAT's (Radio Amateur Satellite Corporation) initial Phase IIIB satellite-based network that will allow the linking of LANs via gateway stations equipped to use this high-orbit satellite. When working, AMICON will allow both intercontinental linking and connection with isolated areas. High data-rate experiments are now being planned for the 23cm/70cm (Mode L) translator aboard Phase IIIB that could point the way for a special high-speed packet-radio transponder package aboard a future AMSAT satellite.

SKIPCON is AMRAD's (Amateur Radio Research and Development Corporation) acronym for an HF-based network of LAN gateways. Due to the vagaries of HF propagation, data rates will be slower here, on the order of 50 to 600 bits per second with forward-error-detection and -correction protocol to ensure data integrity and minimize retransmission. Experiments have been conducted with these techniques since the winter of 1981-1982.

COMMON PACKET-RADIO ABBREVIATIONS

ACK—An acknowledgment from the receiving station indicating that the data was received correctly.
BOP—Bit-Oriented Protocol. This method allows unmodified transmission of information.
CRT—Cathode-Ray Terminal.
FCS—Frame Check Sequence. Method of detecting reception errors.
DLC—High-Level Data-Link Control. This is a BOP protocol which most packet-radio systems use.
LAN—Local Area Network. A network of stations in close geographic proximity.
TAPR—Tucson Amateur Packet Radio.
TNC—Terminal Node Controller. Connects the terminal to the radio system and implements packet protocol.

Where Can I Get a TNC?

At present, there are two TNC designs in common use: the Vancouver TNC and the TAPR TNC.

The Vancouver board is produced by a Canadian group called the Vancouver Amateur Digital Communications Group (VADCG), a nonprofit organization. VADCG is a pioneer in packet radio (the DOC authorized packet use in 1978), and the VADCG TNC is widely used by packeteers. This TNC is supplied as a "bare board." It requires a 4-voltage power supply, an external modem, and the necessary parts to populate it.

Notes are included in the instruction sheets that come with the board for designing the power supply, and VADCG makes a modem kit that is specifically designed for radio use.

The Vancouver TNC design is based on the Intel 8085 CPU and 8273 HDLC controller, 4K bytes of 2114 RAM, and 4K bytes of 2708 EPROM. An 8250 (for serial port) or an 8255 (for parallel port) is needed to interface the station terminal. Contact VADCG or other groups using this TNC for software. It is up to the user to work up the actual radio interface.

A group of amateurs met in Tucson in November, 1981, and decided to get involved in packet radio. Since many in the group were microprocessor hardware-design engineers, as well as real-time programmers, they decided to form a nonprofit organization and design a TNC with the modem, radio interface, and power-supply (exclusive of transformer) circuitry on a single board, for significant cost savings over existing designs. This resulted in the formation of Tucson Amateur Packet Radio (TAPR), a nonprofit corporation, and the development of the TAPR TNC.

The TAPR TNC is based on the 6809 microprocessor and can hold a total of 48K bytes RAM and ROM on the board. It uses the 1933 HDLC chip (fully compatible with the 8273 HDLC format—aren't standards nice?) and has both serial and parallel ports on the board for terminal or computer interface. The TAPR TNC is assembled, tested, and calibrated with all software in place and includes circuitry to interface to most radios. Software sources are listed in the manual that comes with the TNC for running in popular personal computers (to make them act like terminals), along with hardware interconnection information.

I would like to express my sincere thanks to Den Connors KD2S and Chuck Green NØADI for their comments, criticisms, and technical advice.■

RECEIVE WEATHER CHARTS IN YOUR HOME!

You can DX and receive weather charts from around the world.

Tune in on free, worldwide government weather services. Some transmitting sites even send weather satellite cloud cover pictures!

You've heard those curious facsimile sounds while tuning through the bands—now capture these signals on paper!

Assemble ALDEN's new radiofacsimile Weather Chart Recorder Kit, hook it up to a stable HF general-coverage receiver, and you're on your way to enjoying a new hobby activity with many practical applications. Amateurs, pilots, and educators can now receive the same graphic printouts of high-quality, detailed weather charts and oceanographic data used by commercial and government personnel.

Easy to assemble—Backed by the ALDEN name.

For over 40 years, ALDEN has led the way in the design and manufacture of the finest weather facsimile recording systems delivered to customers worldwide. This recorder kit includes pre-assembled and tested circuit boards and mechanical assemblies. All fit together in a durable, attractive case that adds the finishing professional touch.

Buy in kit form and save $1,000!

You do the final assembly. You save $1,000. Complete, easy-to-follow illustrated instructions for assembly, checkout, and operation. And ALDEN backs these kits with a one-year limited warranty on all parts.

Easy to order.

Only $995 for the complete ALDEN Weather Chart Recorder Kit.

To order, fill out and mail the coupon below. For cash orders enclose a check or money order for $995. Add $5 for shipping and handling in the U.S. and Canada, plus applicable sales tax for CA, CO, CT, IA, MA, NY, WI. (Export price is $1250 F.O.B. Westborough, MA. Specify 50 or 60 Hz.) To use your MasterCard or Visa by phone, call (617) 366-8851.

ALDENELECTRONICS

Washington Street, Westborough, MA 01581 ⌐216

NAME:_____

CALLSIGN:_____

ADDRESS:_____

CITY:_____ STATE:_____ ZIP:_____

☐ I've enclosed a check or money order for $995.00 and $5.00 for shipping and handling, plus applicable sales tax.

☐ Charge to: ☐ MasterCard ☐ Visa

ACCOUNT # (ALL DIGITS)

EXPIRATION DATE

SIGNATURE REQUIRED IF USING CREDIT CARD _____

The Interface

Software Available for Six Computers

The versatility of the personal computer gives you a whole new world with the Kantronics Interface™ and Hamsoft™ or Hamtext™. The Interface™ connects to any of six popular computers with Hamsoft™ or Hamtext™ giving you the ability to send and receive CW/RTTY/ASCII. An active filter and ten segment LED bargraph make tuning fast and easy. All programs, except Apple, are on program boards that plug directly into the computer.

Hamtext™, our new program, is available for the VIC-20 and Commodore 64, with all the features of Hamsoft™ plus the ability to save received information to disc or tape, variable buffer sizes, VIC printer compatibility, and much more. Our combination of hardware and software gives you the system you want, with computer versatility, at a reasonable price.

Hamsoft™ Features

Split Screen Display
1026 Character Type Ahead Buffer
10 Message Ports-255 Characters each
Status Display
CW-ID from Keyboard
Centronics Type Printer Compatibility
CW send/receive 5-99 WPM
RTTY send/receive 60, 67, 75, 100 WPM
ASCII send/receive 110, 300 Baud

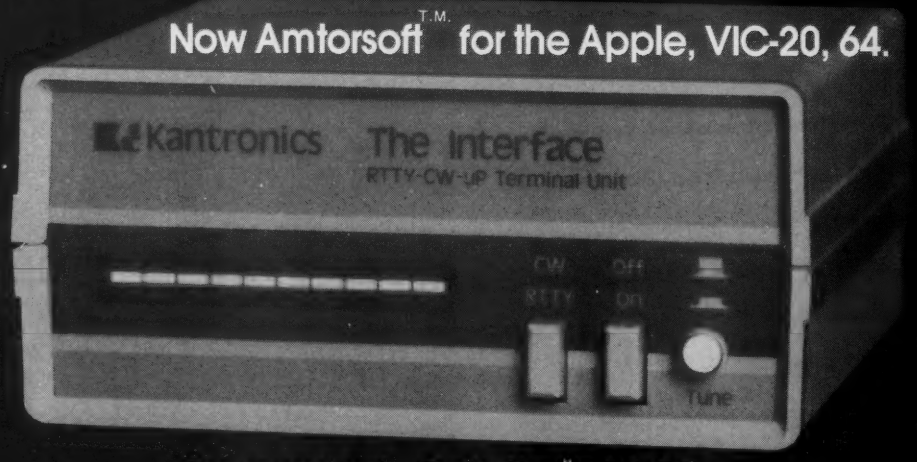
Hamsoft™ Prices

Apple Diskette	$29.00
Atari Board	$49.95
VIC-20 Board	$49.95
TRS-80C Board	$59.95
TI-99 Board	$99.95

Hamtext™ Prices

VIC-20 Board	$99.95
Commodore 64 Board	$99.95

Now Amtorsoft™ for the Apple, VIC-20, 64.

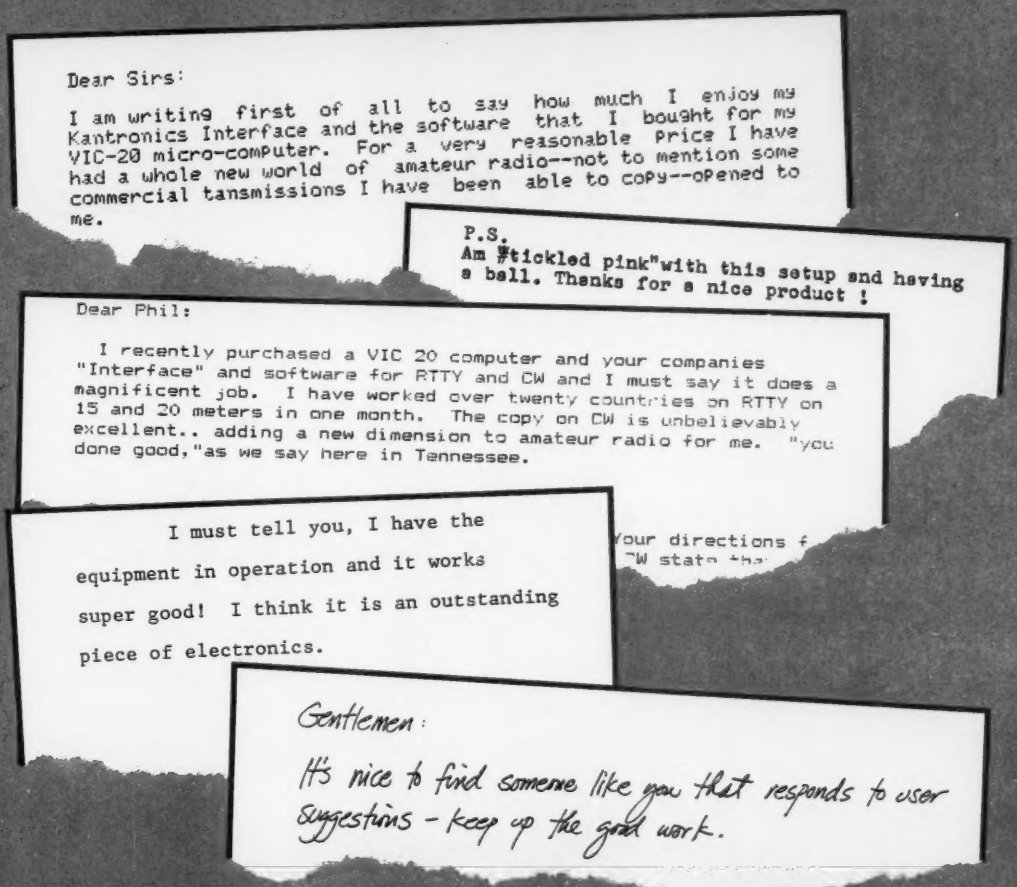


Suggested Retail $169.95

For more information contact your local Kantronics Dealer or:
Kantronics 1202 E. 23rd Street Lawrence, KS 66044

Proven Success

Our best salesmen don't even work for Kantronics



Dear Sirs:

I am writing first of all to say how much I enjoy my Kantronics Interface and the software that I bought for my VIC-20 micro-computer. For a very reasonable price I have had a whole new world of amateur radio--not to mention some commercial tansmissions I have been able to copy--opened to me.

P.S.
Am #tickled pink"with this setup and having a ball. Thanks for a nice product !

Dear Phil:

I recently purchased a VIC 20 computer and your companies "Interface" and software for RTTY and CW and I must say it does a magnificent job. I have worked over twenty countries on RTTY on 15 and 20 meters in one month. The copy on CW is unbelievably excellent.. adding a new dimension to amateur radio for me. "you done good,"as we say here in Tennessee.

I must tell you, I have the equipment in operation and it works super good! I think it is an outstanding piece of electronics.

Gentlemen:

It's nice to find someone like you that responds to user suggestions - keep up the good work.

The Interface is available with software for six popular computers. Hamsoft is our original program for the Apple II, II+, or IIe; Atari 400 or 800; Radio Shack Color Computer, VIC-20, or Texas Instruments TI-99/4A. Hamtext, our advanced program, works with the Apple II, II+, or IIe; VIC-20, or Commodore 64.

The Interface and Hamsoft or Hamtext combination has put computerized communications at a reasonable price. Contact your local Kantronics dealer or write us for more information.

Kantronics

(913) 842-7745
1202 E. 23rd Street
Lawrence, Kansas 66044

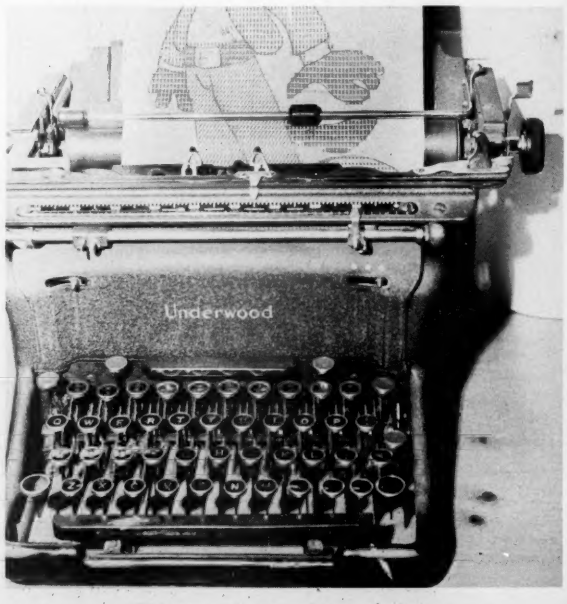
Be a RTTY Rembrandt

Put that award-winning shine on your RTTY pix with these tips from a RTTY artist's sketchbook.

Alfred La Vorgna WA2OQJ
21 Kuhl Avenue
Hicksville NY 11801

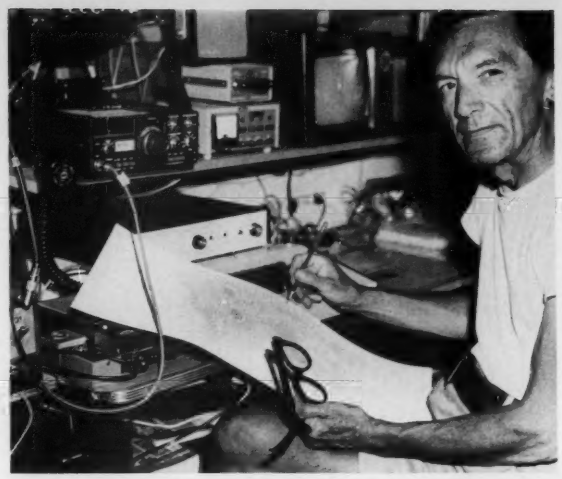
As I always liked art as a hobby, it was natural for me to adapt to RTTY art when I was bitten by the RTTY bug. Knowledge of art techniques need not be a requisite to the creation of good RTTY art. For the benefit of the few who may not know, RTTY pix is the transformation of any picture into a similar image us-

Preparing the cartoon for RTTY.



Close-up of typewriter technique.

The author with a pre-drawn cartoon, set up for RTTY transfer.



The author checking a completed picture.

ing only the upper- and lowercase printout of a hard-copy RTTY machine for transmission on the ham bands. There are new concepts being introduced with the use of computers, but that is an innovation that will develop in a class by itself.

When selecting a picture for copying, select those that have a minimum of detail and are of a north and south composition. Horizontal work is done occasionally, but the vertical format is much easier considering the direction that the paper is flowing from the machine, be it an old Model 19 or a later Model 28. There are many cartoons being transmitted on the bands because of the simplicity of design and elongated format.

Most RTTY artists select a picture from a magazine or newspaper and simply photostat it for insertion into the machine for reproduction by typing over the image. This usually works quite well except for the difficulty of obtaining an image that is long enough. I prefer to use the box method of enlarging as it gives more control over image dimension. Another method is to utilize the artist in the family to make a long skinny drawing. If you are not blessed with such an artist, fear not. You need not be a great artist to accomplish this task.

The typed area on most Teletype® machines averages about seven and one-quarter inches across with a total of 73 characters. Therefore, use seven inches as the width measurement and the up-and-down measurement is unlimited. Pull out five feet of paper from the roll and square it into one-inch spaces allowing the same space on the left-hand margin that your machine allows. Find an illustration that is at least four times longer than it is wide. Cartoons are suggested for early work. Divide the distance across the selected picture into seven segments. The size of one of these segments will be the dimension of all your squares. Now simply copy whatever is in each segment into the one inch squares on your paper. Eliminate as much detail as possible. Pay no attention to the jagged appearance. When you have completed all the squares, you will retrace the rough lines into smooth lines.

Step back from the completed drawing and visualize the dark, light, and medium sections and decide which letters or figures will best accomplish your objective. Try to hold overlines to two passes as this should prove sufficient for most work. Contest rules usually limit overlines to three.

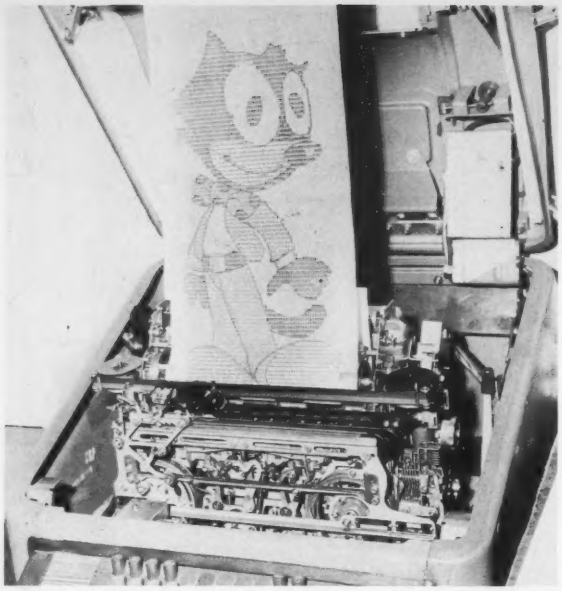
Now we come to the biggest time-saver of all. If you have or can obtain an old vintage typewriter, you will discover that most of them have the same spacing as the RTTY machine. Many old typewriters can be picked up at attractive prices.

If you decide to buy a typewriter, bring along some typed copy from your radioteletype machine. Make a similar copy on your intended purchase and hold both copies up to the light for comparison. Let the light shine through both sheets held together. If only half a letter is lost by the end of a line, you have a good selection, but line-to-line spacing must be very close. Small differences can be made up as I will explain later.

Insert your drawing in the typewriter and type across the top, about six inches down, the numbers 1234567 890 and repeat until you reach 73 numbers. Then do the same down the left-hand side for the length of the sketch. These are reference points for use when you make corrections later and are not copied on the final print. Before you start your print, it is a good idea to make several copies or tracings on additional sheets in case you make too many errors on your first try.

Now insert your sketch into your old nail-buster and start typing right on top of your art work using the letters, numbers, and characters you have selected. Most errors can be erased or typed over. It is best that the ribbon not be too fresh: If an error is too bad, indicate changes with red pencil so you can pick them up later.

When you reach the bot-



A completed picture after RTTY transfer.

Sample copy of a picture as received over the air.

tom, add your title and credit line, transfer the finished work to your machine, and simply type over the copy as your reperf records your pix. You will still make errors, but only a fraction of those that would occur if you typed directly over an original print. You will have to make slight corrections when your print box does not hit the letters directly, adjusting the print accordingly. When I approach more than ½-letter mismatch, I throw up the paper release and gently grasp the paper on either side and make the slight correction by moving the copy. Practice will make these adjustments a quickly solved problem. Do not seek a perfect character match as long as you do not lose a complete space on one line of travel.

It may be more comfortable for you to operate your machine with the cover open for closer viewing of your tape alignment over the typewritten copy. Instead of letting the paper flow over the top of the machine, hang it up over a wire and lightly weight it so you will be able to view the print as a whole as it exits from the rollers.

Here are some suggestions:

- Follow the basic rules of pix-making that are outlined in most contest rules.
- Use no more than 73 characters in one line.
- Use at least ten line feeds at the beginning and end of your picture.
- Use three functions at the beginning of every line. When overlining, use any combination of carriage return, FIGS, or LTRS so as to provide three functions without using line feed.
- Don't forget the guy whose machine does not downshift on space and make sure you add this function or his pix may end up with a lot of 2s where you wanted Ws.

After you have made your tape, print your first playback. Take a red pencil and mark off all the hits and glitches that need correcting. Rerun the tape and correct each error as you are punching your new tape. Unlike the typewritten copy, this time you will have to repunch another tape for any error that you let slip.

If you are going to enter any contests, it is best to make sure you do not have any hidden errors that do not appear in the print, such as unnecessary shift functions or going over a line to add a missing letter. This could cost you points with some judges. You will have to watch for these errors visually as the tape is being run. I have a friend who picks these up on his computer, but this is sneaky.

Finally, when you have all your corrections made, stand back from your print. It will never appear as great as your original typewriter copy, as the outlines of your drawing will no longer appear, but it will develop a character of its own. If at this time you decide that there is either not enough or too much contrast between sections, make another tape and add or subtract characters to these areas.

When you arrive at your final copy and wish to make a print for display, you need not settle for the paper available for teletype machines. Your local art shop has good bond paper in large sheets that you can cut in lengths the same width as your paper roll, providing you have friction feed. Sprocket feed will limit you to sprocket paper. Roll-feed machines have a fine-grade white paper available at stationery supply houses that will produce fine prints for contests and display.

Use a new or re-inked ribbon for final prints. If your reperf produces a chadless-type tape, try to get a chad tape made by a friend for easier storage and mailing. Send your contest print entries in a roller container or neatly rolled in a shoe box to avoid folds. Wrap your prize-winning tape in newspaper to prevent shifting in transit. Of course, you should keep a master copy as there will be no return of your tape or print.

Stop printing everyone else's pix. Make one of your own that will have your call letters on the final line. It is worth the effort. Discover your own little pix tricks. When you create that winner, you can display it on the shack wall with pride. You may even want to copy it on high-contrast line film and make your own unique photographic QSL cards. Let's see your pix on the page soon. ■

WE SHIP WORLDWIDE

Barry Electronics Corp.

WORLD WIDE AMATEUR RADIO SINCE 1950

Your one source for all Radio Equipment!

For the best buys in town call:
212-925-7000
Los Precios Mas Bajos en Nueva York...

"It's Barry for the Best in Amateur & Commercial Radios"

KITTY SAYS: WE ARE NOW OPEN 7 DAYS A WEEK.
Saturday & Sunday 10 to 5 PM
Monday-Friday 9 to 6:30 PM
Come to Barry's for the best buys in town. For Orders Only Please Call: 1-800-221-2683.

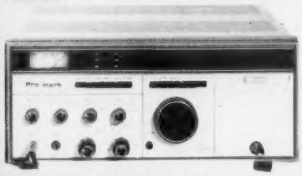
ICOM
IC-R70, IC-720A, IC-730, IC-740, IC-25A/H, IC-35A
IC-45A, IC-251A, IC-2KL, IC-471A, IC-290H, IC-751

YAESU
FT-ONE, FT-980, FT-102, FT-77, FT-707, FT-230R FT-757
FT-726R, FT-480R, FT-720RU, FT-290R, FRG-7700, FT-625RD

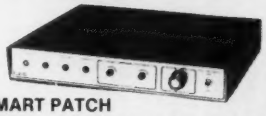
YAESU
FT-208R
FT-708R
FTC-1903

ICOM
IC2AT
IC3AT
IC4AT

Land-Mobile H/T
Midland
Wilson Mini-Com II
Yaesu FTC-2203, FT-4703
Icom IC-M12 (Marine)
Tempo M-1



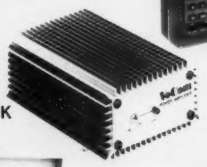
DRAKE TR-5, TR-7A, R-7A, L-7, L-15, Earth Satellite Receiver ESR-24, THETA 9000E & 500, EARTH SATELLITE STATION ESS-2250



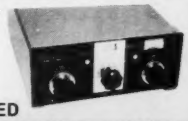
ROCKWELL/COLLINS
KWM-380

SMART PATCH
CES-Simplex Autopatch 510-SA Will Patch FM Transceiver To Your Telephone. Great For Telephone Calls From Mobile To Base. Simple To Use - $319.95.

VoCom/Mirage
Tokyo Hy-Power
Amplifiers &
5/8λHT Gain
Antennas IN STOCK



SANTEC
ST-220/UP
ST-144/UP
ST-440/UP



NEW IMPROVED
MURCH Model
UT2000B

MFJ Models
900, 940B, 941C & 982

DENTRON AMPLIFIERS
GLA-1000C

Computer Interfaces stocked:
MFJ-1224
AEA CP-1
Kantronics

Repeaters in Stock:
Spectrum SCR-1000, 4000, & 77
ICOM IC-RP 3010 (440 MHz)
ICOM IC-RP 1210 (1.2 GHz)

KANTRONICS
Field Day 2, Mini-Reader, Interface, Software & Code Tapes

Complete Butternut Antenna Inventory In Stock!

Robot 800C - 1200C Color Mod Kits

Long-range Wireless Telephone for export in stock

BENCHER PADDLES & Vibroplex Keys In Stock!!

DIGITAL FREQUENCY COUNTER
Trionyx-
Model TR-1000
0-600 MHz
Digimax Model
D-510 50 Hz-1GHz

EIMAC
3-500Z
572B, 6JS6C
12BY7A &
4-400A

BIRD
Wattmeters &
Elements
In Stock

AEA 144 MHz
AEA 440 MHz
ANTENNAS

New TEN-TEC
Corsair In Stock

Tri-Ex Towers
Hy-Gain Towers
& Antennas,
and Rotors
will be shipped direct
to you FREE of shipping cost.

MAIL ALL ORDERS TO BARRY ELECTRONICS CORP., 512 BROADWAY, NEW YORK CITY, NY 10012.

New York City's LARGEST STOCKING HAM DEALER
COMPLETE REPAIR LAB ON PREMISES

"Aqui Se Habla Espanol"

BARRY INTERNATIONAL TELEX 12-7670
TOP TRADES GIVEN ON USED EQUIPMENT
STORE HOURS: Monday-Friday 9 to 6:30 PM
Parking Lot Across the Street
Saturday & Sunday 10 to 4 PM (Free Parking)
AUTHORIZED DISTS. MCKAY DYMEK FOR SHORTWAVE ANTENNAS & RECEIVERS.

Subways: IRT/LEX-"Spring St. Station"
BMT-"Prince St. Station"
IND-"F" Train-Bwy. Station"

Bus: Broadway #6 to Spring St.

Heil Sound Eq.
Mike cartridges
and books in
stock.

We Stock: AEA, ARRL, Alpha, Ameco, Antenna Specialists, Astatic, Astron, B & K, B & W, Bash, Bencher, Bird, Butternut, CDE, CES, Collins, Communications Spec. Connectors, Covercraft, Cubic (Swan), Cushcraft, Daiwa, Dentron, Digimax, Drake, ETO (Alpha), Eimac, Encomm, Heil-Sound, Henry, Hustler (Newtronics), Hy-Gain, Icom, KLM, Kantronics, Larsen, MCM (Daiwa), MFJ, J.W. Miller, Mini-Products, Mirage, Newtronics, Nye Viking, Palomar, RF Products, Radio Amateur Callbook, Robot, Rockwell Collins, Saxton, Shure, Swan, Telex, Tempo, Ten-Tec, Tokyo Hi Power, Trionyx TUBES, W2AU, Waber, Wilson, Yaesu Ham and Commercial Radios, Vocom, Vibroplex, Curtis, Tri-Ex, Wacom Duplexers, Repeaters, Phelps Dodge, Fanon Intercoms, Scanners, Crystals.

WE NOW STOCK COMMERCIAL COMMUNICATIONS SYSTEMS
DEALER INQUIRIES INVITED. PHONE IN YOUR ORDER & BE REIMBURSED.

COMMERCIAL RADIOS stocked & serviced on premises.

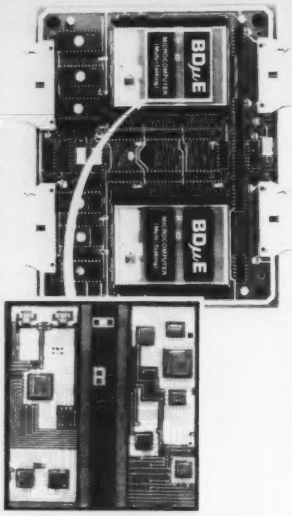
Amateur Radio & Computer Courses Given On Our Premises, Call

Export Orders Shipped Immediately. TELEX 12-7670

See List of Advertisers on page 114

The UNIVERSAL

a) INTERFACE
b) CODE CONVERTER
c) MONITOR
d) REMOTE CONTROLLER
e) TNC
f) ANTENNA CONTROLLER
g) COMPUTER
(h) ALL OF THE ABOVE



The Industrial/OEM world DOES have something you can use right now!

The Model #964-L features:

Processor Board:
- Dual multi-layer gold-on-ceramic thick-film hybrids. Each has
  - CMOS 6805 8-bit microprocessor
  - 6818 Real Time Clock
  - 4 Mhz crystal
  - 16 buffered bidirectional I/O lines
- 1K byte of volatile CMOS RAM shared by both microprocessors
- 256 bytes of non-volatile NMOS RAM shared by both microprocessors
- Six sockets for 2716 UVPROM's, three per microprocessor
- Requires less than one Watt at +5VDC
- Data and address buses available from each microprocessor via a 50 pin ribbon connector

Analog I/O Board:
- 4 channels A/D, 4-20 mA
- 4 channels D/A, 4-20 mA
- 12 bit resolution
- Requires ±15VDC and +5VDC

Digital I/O Board:
- 16 buffered digital inputs with pull-up resistors for contact closure
- 16 high-voltage, high-current Darlington transistor buffered outputs, isolated suppression and power returns
- Requires +5VDC

Serial Interface Board:
- Selectable baud rate
- Requires ±12VDC and +5VDC
- RS-232 or RS-422

Power Supply Board:
- Input +12VDC unregulated
- Outputs ±12VDC, ±15VDC, +5VDC

General Features:
- 0° to 70° C. operating temperature range
- Very low power consumption
- Rugged 8½" x 11" x 4" alloy enclosure
- Solar powered applications feasible
- Liberal 1-year limited warranty

Industrial programmed versions start at over $4,000 and go up quickly. This unprogrammed introductory special stays at $1495 as long as we can maintain the price. Shipping and handling extra depending on UPS mode you specify. Arizona residents add 7% sales tax.

Individual board prices upon request, many combinations useful. Dealer and quantity discount inquiries welcome.

For a brief description use the reader service card; for a detailed manual, including schematics, send $6.00 (postpaid and deductible from subsequent order) to:

B & D Microenterprises, Inc.
P.O. Box 5583
Tucson, AZ 85703
(602) 623-6880 (for orders only, please)

↙70

Please Clip and Mail

I am enclosing $_____ for _____ 964-L(s), _____ literature.
Specify UPS ship't options: _____
Please charge my: ☐ VISA, ☐ MC (Interbank # _____)
Acc't # _____ Exp. _____
Signature: _____
Name: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: ( )_____

WATCH FOR HAL'S NEW PRODUCTS

HAL 2304 MHz DOWN CONVERTERS (FREQ. RANGE 2000/2500 MHz)
2304 MODEL #1 KIT BASIC UNIT W/PREAMP LESS HOUSING & FITTINGS **$19.95**
2304 MODEL #2 KIT (with preamp) **$29.95**
2304 MODEL #3 KIT (with High Gain preamp) **$39.95**
MODELS 2 & 3 WITH COAX FITTINGS IN & OUT AND WITH WEATHER-PROOFED DIE CAST HOUSINGS
BASIC POWER SUPPLY **$19.95**
POWER SUPPLY KIT FOR ABOVE WITH CASE **$24.95**
FACTORY WIRED & TESTED **$34.95**
ANTENNAS & OTHER ACCESSORIES AVAILABLE. SEND FOR MORE INFO.

2100-2500 MHZ

*HMR-II COMPLETE UNIT
COMPLETE SYSTEM AS SHOWN. *NOT A KIT.* INCLUDES A PC BOARD, POWER SUPPLY, CABLES & CONNECTORS—PRE-ASSEMBLED AND TESTED. 24dB GAIN OR GREATER.
1-4 units ..... $89.95 ea.
5 or more units ..... $79.95 ea.

*HAM MICROWAVE RECEIVER

PRE-SCALER KITS

HAL 300 PRE .....(Pre-drilled G-10 board and all components) **$14.95**
HAL 300 A/PRE .....(Same as above but with preamp) **$24.95**
HAL 600 PRE .....(Pre-drilled G-10 board and all components) **$29.95**
HAL 600 A/PRE .....(same as above but with preamp) **$39.95**

TOUCH TONE DECODER KIT

HIGHLY STABLE DECODER KIT. COMES WITH 2 SIDED, PLATED THRU AND SOLDER FLOWED G-10 PC BOARD, 7-567's, 2-7402, AND ALL ELECTRONIC COMPONENTS. BOARD MEASURES 3-1/2 x 5-1/2 INCHES. HAS 12 LINES OUT. ONLY **$39.95**

NEW—16 LINE DELUXE DECODER **$69.95**

DELUXE 12-BUTTON TOUCHTONE ENCODER KIT UTILIZING THE NEW ICM 7206 CHIP PROVIDES BOTH **VISUAL** AND **AUDIO** INDICATIONS! COMES WITH ITS OWN TWO-TONE ANODIZED ALUMINUM CABINET MEASURES ONLY 2¾"x3¼" COMPLETE WITH TOUCH-TONE PAD. BOARD, CRYSTAL, CHIP AND ALL NECESSARY COMPONENTS TO FINISH THE KIT. **PRICED AT $29.95**

NEW—16 LINE DELUXE ENCODER **$39.95**

HAL ECD—16 LINE DELUXE ENCODER INCLUDES PC BOARD, ALL PARTS & CASE **$39.95**

HAL ECD—12 LINE DELUXE ENCODER COMPLETE WITH PC BOARD, ALL PARTS & CASE **$29.95**

ACCUKEYER (KIT) THIS ACCUKEYER IS A REVISED VERSION OF THE VERY POPULAR WB4VVF ACCUKEYER ORIGINALLY DESCRIBED BY JAMES GARRETT, IN QST MAGAZINE AND THE 1975 RADIO AMATEUR'S HANDBOOK **$16.95**

ACCUKEYER—MEMORY OPTION KIT PROVIDES A SIMPLE, LOW COST METHOD OF ADDING MEMORY CAPABILITY TO THE WB4VVF ACCUKEYER. WHILE DESIGNED FOR DIRECT ATTACHMENT TO THE ABOVE ACCUKEYER. IT CAN ALSO BE ATTACHED TO ANY STANDARD ACCUKEYER BOARD WITH LITTLE DIFFICULTY **$16.95**

BUY BOTH THE MEMORY AND THE KEYER AND **SAVE** COMBINED PRICE ONLY **$32.00**

PRE-AMPLIFIER

HAL-PA-19 WIDE BAND PRE-AMPLIFIER, 2-200 MHz BANDWIDTH (– 3dB POINTS). 19 dB GAIN
FULLY ASSEMBLED AND TESTED $8.95

HAL-PA-1.4 WIDE BAND PRE-AMPLIFIER, 10 MHz TO 1.4 GHz. 12dB GAIN
FULLY ASSEMBLED $12.95

CLOCK KIT—HAL 79 FOUR-DIGIT SPECIAL—$7.95. OPERATES ON 12-VOLT AC (NOT SUPPLIED) PROVISIONS FOR DC AND ALARM OPERATION.

6-DIGIT CLOCK•12/24 HOUR

COMPLETE KIT CONSISTING OF 2 PC G-10 PRE-DRILLED PC BOARDS, 1 CLOCK CHIP, 6 FND COMM. CATH. READOUTS, 13 TRANS., 3 CAPS, 9 RESISTORS, 5 DIODES, 3 PUSHBUTTON SWITCHES AND INSTRUCTIONS. DON'T BE FOOLED BY PARTIAL KITS WHERE YOU HAVE TO BUY EVERYTHING EXTRA. WILL RUN OFF ANY 12-VOLT AC SUPPLY. **PRICED AT $12.95**

CLOCK CASE AVAILABLE AND WILL FIT ANY ONE OF THE ABOVE CLOCKS. REGULAR PRICE . . . $6.50 **BUT ONY $4.50 WHEN BOUGHT WITH CLOCK.**

SIX-DIGIT ALARM CLOCK KIT FOR HOME, CAMPER, RV, OR FIELD-DAY USE. OPERATES ON 12-VOLT AC OR DC, AND HAS ITS OWN 60-Hz TIME BASE ON THE BOARD. COMPLETE WITH ALL ELECTRONIC COMPONENTS AND TWO-PIECE, PRE-DRILLED PC BOARDS. BOARD SIZE 4" × 3". COMPLETE WITH SPEAKER AND SWITCHES. IF OPERATED ON DC, THERE IS NOTHING MORE TO BUY*
PRICED AT $16.95

*TWELVE-VOLT AC LINE CORD FOR THOSE WHO WISH TO OPERATE THE CLOCK FROM 110-VOLT AC **WHEN PURCHASED WITH CLOCK KIT $2.95**

SHIPPING INFORMATION: ORDERS OVER $25 WILL BE SHIPPED POST-PAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN $25, PLEASE INCLUDE ADDITIONAL $2.00 FOR HANDLING AND MAILING CHARGES. SEND 20¢ STAMP FOR FREE FLYER.

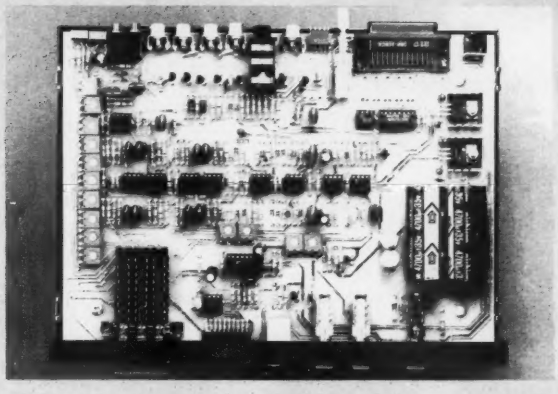
DISTRIBUTOR FOR
Aluma Tower• AP Products
(We have the new **Hobby-Blox System**)

"HAL" HAROLD C. NOWLAND
W8ZXH

HAL-TRONIX
P. O. BOX 1101
SOUTHGATE, MICH. 48195
PHONE (313) 285-1782

↙31

CHAMPAGNE RTTY/CW on a Beer Budget



CP-1 Computer Patch™ Interface

The AEA Model CP-1 Computer Patch™ interface will let you discover the fastest growing segment of Amateur Radio: computerized RTTY and CW operation.

When used with the appropriate software package (see your dealer), the CP-1 will patch most of the popular personal computers to your transceiver for a complete full-feature RTTY/CW station. No computer programming skills are necessary. The CP-1 was designed with the RTTY neophyte in mind, but its sophisticated circuitry and features will appeal to the most experienced RTTY operator.

The CP-1 offers variable shift capability in addition to fixed 170 Hz dual channel filtering. Auto threshold plus pre and post limiter filters allow for good copy under fading and weak signal conditions.

Transmitter AFSK tones are generated by a clean, stable function generator. Plus (+) and minus (-) output jacks are also provided for CW keying of your transmitter. An optional low cost RS-232 port is also available. The CP-1 is powered with 16 VAC which is supplied by a 117 VAC wall adaptor included with the CP-1.

THE HAM SHACK

808 N. Main St.
Evansville, IN 47711
(812) 422-0231

AEA
Brings you the Breakthrough!

See List of Advertisers on page 114

Leon Fletcher N6HYK
1360 Josselyn Canyon Road #46
Monterey CA 93940

How to Increase Your QSOs

N6HYK's seasoned advice will add spice to your CW contacts—even if you aren't a Novice.

Ten students were in the fall, 1981, 10-week course at Pacific Grove Adult School in California, studying to take the tests for licensing as Novices. The instructor, Paul Herrschaft KQ6G, presented excellent instruction—70% of his students passed the FCC test on the first try; the rest passed soon after.

But today, more than a year later, only one of those students is on the air. Why?

There are several reasons, of course. But many Novices tell me there's one big problem that stands out above all others in keeping them off the air: the lack of practical, specific tips on just how to handle CW contacts.

That's no criticism of KQ6G's course, nor, probably, of other typical Novice classes offered around the country. Rather, there is a severe shortage of the specific information every Novice needs immediately after he or she has passed the FCC tests: the tips and techniques about actual on-the-air operation.

But Novices are not the only hams who can benefit from the following details. I've heard many General-class operators, and even a good many Advanceds and Extras, making basic operating goofs, sounding as if it were their first day on a key.

Yet the tips in this article are seldom seen in print or heard from fellow hams. Search, as I have, the standard operating manuals, handouts, instructional guides, and such, and you'll find very little of this kind of information. Mostly all you'll read in the publications and hear from other hams are generalities. "Be patient," reads one. Another suggests, "Be persistent." Such vague words are of little real help.

Here, then, are nitty-gritties about how to search a band, how to increase the number of your QSOs, and how to be a better operator. Here are 11 practical, QSO-tested techniques.

These tips are based on two sources. Most came to me the hard way, from my own on-the-air experiences. But I'm not passing myself off as an expert operator. Rather, I'm a Novice who's disappointed with the limited help available to beginners and aware of the need for experienced hams to be better operators. So, as I began operating my station, I took detailed notes of the problems—and solutions—I met.

That system paid off. It took me just 53 days on the air to contact all states. The last one, Domenico Procida KAØMEI, in McLaughlin, South Dakota, came on the 15-meter band at 1929 UTC, shortly before noon my time, in California, on Tuesday, November 2, 1982. Now, I'm not suggesting that's any kind of record. Rather, I offer such specifics to show you that by using these techniques you can indeed improve your own on-the-air successes.

This is my shack. Here I learned the hard way, through on-the-air experience, the basic tips and techniques presented in this article, not to be found in existing manuals, guides, etc. As I operate, I can glance at stick-on notes posted as reminders: "7,228: Hawaii Storm Net"; WA6IRZ Stan Bringer sked, 3900, 10 pm"; "VE districts needed. . ."

ALL ITEMS ARE GUARANTEED OR SALES PRICE REFUNDED.
PRICES F.O.B. HOUSTON
PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
ITEMS SUBJECT TO PRIOR SALE.

MADISON
Electronics Supply

↩45

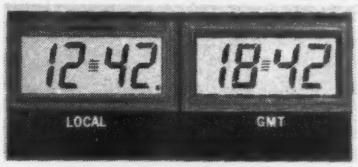
Houston COM-VENTION '83
The 1983 ARRL National
Oct. 7-9, 1983
Astro Village Hotel

SIGNAL ONE
Milspec 1030 ..... $4995.00
ROBOT 800 ..... 447.00
AEA MM2 ..... 149.00
CK2 ..... 129.00
HAL ST6K 229.00
ST5000 ..... 209.00
TOKYO HYPOWER
HC200 Tuner 89.00
HC2000 Tuner 289.00
HL10160V Amp 289.00
HL30160V Amp 249.00
BELDEN CABLE
9258 RG8x ..... 19¢/ft
8214 RG8 foam ..... 39¢/ft
8237 RG8 ..... 36¢/ft
8235 300 Ohm kW twinlead ..... 20¢/ft
8000 14 Ga. stranded ant. ..... 10¢/ft
8267 RG213 ..... 46¢/ft
8448 rotorcable ..... 27¢/ft
9405 heavy rotor cable .. 45¢/ft
KDK 2030 2M FM 259.00
SANTEC 144μP 279.00
400μP 299.00
ST7T 230.00
JANEL, SHERWOOD 10% off list
DRAKE TR7A/RV75 ... 1700.00
TR7A 1389.00
ROCKWELL KWM380 . 3995.00
QSL Holder or Coax Seal 2.00 ea
TCG 2.5A/1000PIV ..... 19¢
BENCHER ST2
Chrome singlelever 45.00
Call Don for Sony Prices
BIRD 43 & elements ..... Stock
ROBOT 1200C SSTV .. 1139.00
450C 789.00
800C 789.00
400C Kit 469.00
800C Kit 155.00
JERSEY Specialty
RG213 ..... 29¢/ft
RG8X ..... 14¢/ft
AMPHENOL PL259
Silverplate 1.25
SURPLUS SALES
Resistors 1/4, 1/2, 1, 2 Watt ..... .10¢ea.
Caps to 1mFd, 100 V ... .25¢ ea
Tubes, Schematics, Meters, Switches, Coils, Connectors, and a bunch more in stock.

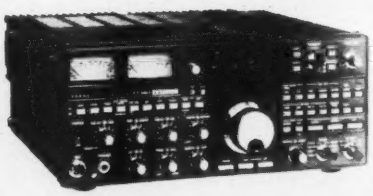
Madison-Hal: Trade up your old VIC20, Kantronics, software or VIC20, AEA, software for new Hal CT2200, KB2100 system, $900.00 difference, fob Houston

Let Madison Outfit Your Radio Room With Back-to-School Values!

Big LCD Clock
GMT/Local twin display, black frame with large, easy-to-read display (.6" high)
Batteries included. **$29.95** + **$1.50** shipping.



HAM TAGS
$12.95 + **$1.50** shipping



YAESU

FT980 ..... Call
FT77 ..... 539.00
FT ONE w/accessories ... 2300.00
FT208RA 269.00
Full line of Yaesu accessories in stock!
SP107 (limited) 20.00
FT230 ..... 299.00

ANTENNAE

HF6V $125.00
6BTV 139.00
V2S 2 Meter 39.00
18AVT/WBS 100.00
3TBA - Hustler 199.00
5BTV 99.00
TH7DX 349.00
Explorer 14 ..... 269.00
7 or 10 MHz Kit 79.00
HD73 Rotor 99.00
Ham 4 Rotor 199.00

ETO ALPHA

Great prices - call!
Example of a great deal: 76PA for $1690
Alpha work and all mods by our Factory Technician.

COMPUTER CORNER: Call our techs on Saturday morning for advice on hooking up and operating your Madison purchased computer items. We offer service after the sale for everyone.

AEA CP1 ..... $199.00
Software in stock (10% discount)
With CP1 purchase -
MFJ 1224 Interface $79.95
Kantronics Interface 139.00

DON'S CORNER:

Everything in life seems a big mystery to us, including the world of the ham. Kids have less fear of the unknown than us, so why not introduce some youngster to the fascination of ham radio. It's a good feeling. I know. I've done it.

Don't shrink away from the idea of buying a new radio because you're sure a new one will come out next week. The options and quality has never been as good as it is now. The new crop of radios amazes me. Bells and whistles galore, and yet our warranty repair load is a fraction of just a year ago. There was this CB'er who brought in his rig for repair after getting so mad at it that he shot it . . . honest.

73, Don

We will open and inspect all equipment at your request. Accessories purchased will be installed and tested without charge.

IF IT'S NOT LISTED, CALL ME!!

1508 McKINNEY
HOUSTON, TEXAS 77010

↩45

***CALL FOR QUOTES**
713-658-0268

We stock what we advertise, and much more.
TOLL FREE - ORDERS ONLY
1-800-231-3057

↩See List of Advertisers on page 114

A beginner's collection of QSL cards can grow surprisingly fast. As cards come in, the XYL often gets interested in them.

Referring to my log, I find added pleasure in hamming by pinpointing the location of a station soon after completing a QSO. This one, Jim Wesseling KA9MXO from Spring Grove, Illinois, will have a red dot added to the map to help me keep track of the spread of my QSOs throughout the nation.

The other source for these tips was the 96-member U.S. Naval Postgraduate School Amateur Radio Club in Monterey, California. At one of its monthly meetings, I asked members to tell me specifics they thought would help improve operating skills.

Here's what I learned.

1) *Headphones*: This tip stands out far above all others for two reasons. First, it is absolutely essential. Second, it is rarely mentioned in any of the usual lists of operating tips.

Get yourself a really good set of communication-style headphones. Tell that to the typical ham who's been on the air a month or so and he, or she, may stare at you as if you'd just announced that people need air to breathe. The need, the value, of headphones is apparently so obvious it's almost never mentioned. But there are some rank beginners—I, for one—who need to be told about the need for a headset.

Good phones increase the volume. They focus your attention. They sharpen your listening. They reduce other sounds. They improve, greatly and immediately, your operating. They're indispensable. Absolutely.

How to choose your phones is, frankly, beyond my technical knowledge. I just went to a major dealer of ham equipment and said, "Show me your very best phones." He offered three. I found one felt heavy. Another looked like inferior workmanship. As I picked the third, the salesman said, "That's the set I've found best." My selection: Kenwood HS-5. I have no idea how they measure up with other phones technically. But they fit me, sound great, feel good, and significantly increase my operating skills.

The rest of these tips are not in any order of priority. You should pick out the ones which will help you most at the level of on-the-air operating you're at right now, then make mental notes to use the other tips as the need may arise.

2) *Listen around the "Big Guns."* They're those superpowerful stations. Often they pour out CW at 15 or more words a minute, somehow expecting Novices to answer. Once you hear one of them, tune carefully, slowly, intently, just above and just below their signals. A great many times I've found those powerhouses come on the air and hide, but not completely block, some smaller, less powerful, slower CQer. Often, that modest-sounding station is much more interesting to QSO. He, or she, may often be more eager, receptive, and considerate of your slower, less skilled, less confident operating.

3) *Listen at a "hangout."* That's what I call a spot on the band where stations gather. When 40 meters is open, for example, it's usually at the very lowest end of the band. Then, often, up around say 7.110 to 7.120, there may be a relatively open space, followed by another hangout. If there are but, say, five or so hams operating in those groups, you might be able to catch a CQ quickly and easily. But if ten or more stations are working the hangout, singling one out may be difficult. According to my ears, they just beat each other up, block each other, cut out each other, and interfere with themselves and with potential contacts. They may become a pileup. So I tune elsewhere. I search for another group, but a small, responsible, orderly group. There, often, I can find a good station that is "contactable," if that's a word.

4) *Listen where there's no action.* Chris Thais NQ6Q of Monterey, California, told me, "When I turn my transceiver on, I generally check out the overall sound that's on the air. If I don't hear any traffic, it doesn't necessarily mean the band is down." He sends out a CQ anyway, and, surprisingly often, he says, he gets a contact.

5) *Consider the problems of that old tip, "Send your CQ and your call at the speed you want to copy."* Generally, that's a good technique. But sometimes it may help to send it slower than you can or want to copy. If you're cautious, as I am, you could figure a slower CQ may help make sure someone hears you clearly and correctly.

On the other hand, you'll increase your CW speed if you extend yourself a bit now and then. At least once a day, I give a call to a key that's buzzing along three or so words faster than my present best speed. You, too, should push yourself into copying faster than you feel is comfortable, at least now and then. Sure, you may miss some copy. But you don't have to send "SOLID" after every listen. I find that in a few days of copying somewhat over my speed, I can then move my rate of CQing up a bit and copy most of what comes back with comfort.

6) *When you fumble, slow down!* Don't let yourself fall

ICOM - Check the Savings at AES®!

HF Transceivers:	Regular	SALE
IC-740* 9-band 200w PEP Xcvr	$1099.00	949.95

*plus **FREE PS-740** Internal power supply &
$50 Factory Rebate until gone!

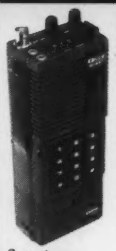
PS-740 Internal power supply	$159.00	149.95
EX-241 Marker unit	20.00	
EX-242 FM unit	39.00	
EX-243 Electronic keyer unit	50.00	
FL-44 SSB filter (2nd IF)	159.00	129.95
FL-45 500 Hz CW filter (1st IF)	59.50	
FL-54 270 Hz CW filter (1st IF)	47.50	
FL-52 500 Hz CW filter (2nd IF)	96.50	89.95
FL-53 250 Hz CW filter (2nd IF)	96.50	89.95
MB-12 Mobile mount	19.50	
HM-10 Mobile scan microphone	39.50	
IC-730 8-band 200w PEP Xcvr w/mic	$829.00	649.95
FL-30 SSB filter (passband tuning)	59.50	
FL-44 SSB filter (2nd IF)	159.00	129.95
FL-45 500 Hz CW filter	59.50	
EX-195 Marker unit	39.00	
EX-202 LDA interface; 730/2KL/AH-1	27.50	
EX-203 150 Hz CW audio filter	39.00	
EX-205 Transverter switching unit	29.00	
HM-10 Mobile scan microphone	39.50	
MB-5 Mobile mount	19.50	
IC-720A 9-band Xcvr/.1-30 MHz Rcvr	$1349.00	899.95
FL-32 500 Hz CW filter	59.50	
FL-34 5.2 KHz AM filter	49.50	
MB-5 Mobile mount	19.50	
IC-7072 transceive interface, R-70	112.50	
New Model!	Regular	SALE
IC-751 9-band xcvr/.1-30 MHz Rcvr	$1399.00	1259
PS-35 Internal power supply	160.00	144.95
FL-52A 500 Hz CW filter	TBA	
FL-53A 250 Hz CW filter	TBA	
FL-33 AM filter	TBA	
HM-12 Hand microphone	TBA	
SM-6 Desk microphone	TBA	
External frequency controller	TBA	
High stability reference crystal	TBA	
Accessories: 720/730/740	Regular	SALE
PS-15 External 20A power supply	$149.00	134.95
EX-144 Adaptor; CF-1/PS-15	6.50	
CF-1 Cooling fan for PS-15	45.00	
PS-20 20A switching ps w/speaker	229.00	199.95
CC-1 Adaptor; HF radio to PS-20	10.00	
CF-1 Cooling fan for PS-20	45.00	
SM-5 8-pin electret desk mic	39.00	
SP-3 External speaker	49.50	
Speaker/phone patch (specify radio)	139.00	129.95
AT-100 100w 8-band automatic ant tuner	349.00	314.95
AT-500 500w 9-band automatic ant tuner	449.00	399.95
AH-1 5-band mobile ant w/tuner	289.00	259.95
HF Linear Amplifier	Regular	SALE
IC-2KL 160-15m/WARC solid state linear	1795.00	1299

VHF/UHF Multi-modes:	Regular	SALE
IC-251A 2m FM/SSB/CW Xcvr/AC ps	$749.00	549.95

$50 Factory Rebate until gone!

IC-551D 80w 6m Xcvr	$699.00	599.95
PS-20 20A switching ps/spkr	229.00	199.95
CF-1 Cooling fan for PS-20	45.00	
EX-106 FM adaptor	125.00	112.95
IC-451A 430-440 SSB/FM/CW Xcvr/ps	899.00	699.95
IC-451A/High 440-450 MHz Xcvr/ps	899.00	699.95
AG-1 15 db preamp, IC-451A/45..	89.00	79.95
VHF/UHF FM:	Regular	SALE
IC-25A 2m, 25w, up-dn-ttp mic, grn leds	$359.00	319.95
IC-25H as above, but 45 watts	389.00	349.95
IC-25A '82 model; 25w, ttp mic, red leds	349.00	289.95
IC-45A 440 FM xcvr, 10w, TTP mic	399.00	359.95
IC-22U 10w 2m FM non-digital Xcvr	$299.00	249.95
EX-199 Remote frequency selector	35.00	
VHF/UHF Multi-modes:	Regular	SALE
IC-290A 2m FM/SSB, TTP mic	$549.00	389.95
IC-290H 25w 2m SSB/FM Xcvr, TTP mic	549.00	489.95
IC-560 10w 6m SSB/FM/CW Xcvr	489.00	439.95
IC-490A 10w 430-440 SSB/FM/CW Xcvr	649.00	579.95
VHF/UHF Portables:	Regular	SALE
IC-202S 2m port. SSB Xcvr, 3w PEP	$279.00	249.95
IC-505 3/10w 6m port. SSB/CW Xcvr	449.00	399.95
BP-10 Internal nicad battery pack	79.50	
BC-15 AC charger	12.50	
EX-248 FM unit	49.50	
LC-10 Leather case	34.95	
IC-3PS Power supply	95.00	89.95
IC-20L 2m amp, 10w PEP or FM	98.00	89.95
IC-30L 432 amp, 10w PEP/FM	105.00	94.95
New models!	Regular	SALE
IC-120 1.2 GHz FM mobile	499.00	449.95
RP-1210 1.2 GHz, 10w repeater	999.00	899.95
IC-271A 2m, 25w multimode	699.00	629.95
IC-471A 430-450 MHz, 10w xcvr	799.00	719.95
RP-3010 440 MHz repeater	999.00	899.95

Shortwave receiver	Regular	SALE
R-70 100KHz-30MHz digital receiver	$749.00	649.95
EX-257 FM unit	38.00	
IC-7072 Transceive interface, 720A	112.50	
FL-44 SSB filter (2nd IF)	159.00	129.95
FL-63 250 Hz CW filter (1st IF)	48.50	
SP-3 External speaker	49.50	
EX-299 (CK-70) 12V option	9.95	
MB-12 Mobile mount	19.50	



ICOM Handhelds

The Transceivers. The IC-2A features full coverage of the 2 meter ham band. The IC-3A covers 220 to 224.99 Mhz, and the IC-4A, 440 to 449.995 Mhz. Each comes with BP-3 rechargable battery, AC wall charger, flex antenna, earphone, wrist strap, and belt clip. Accessories are interchangable. Slide on, removable battery pack allows quick change and may be charged while removed from transceiver.

2 meters:	Regular	SALE
IC-2A .15/1.5w 2m HT/batt/wall cgr	$ 239.50	214.95
IC-2AT .15/1.5w 2m HT/batt/cgr/TTP	269.50	219.95
220 MHz:		
IC-3A 220 HT/batt/wall cgr	269.95	229.95
IC-3AT .15/1.5w 220 HT/batt/cgr/TTP	299.95	239.95
440 MHz:		
IC-4A .15/1.5w 440 HT/batt/wall cgr	269.95	229.95
IC-4AT .15/1.5w 440 HT/batt/cgr/TTP	299.95	239.95

Hand-held Accessories:	Regular
BC-25U Extra 15-hour wall charger	$10.00
BC-30 1/15-hour drop-in charger for BP-2/3/5	69.00
BP-2* 450 ma, 7.2v 1w ext. time battery	39.50
BP-3 Extra std. 250ma 8.4v 1.5w battery	29.50
BP-4 Alkaline battery case	12.50
BP-5* 450 ma, 10.8v 2.3w hi-power battery	49.50
BC-30 required to charge BP-2 & BP-5	
FA-2 Extra 2m flexible antenna	10.00
CA-2 Telescoping ¼-wave 2m antenna	10.00
CA-5 ⅝-wave telescoping 2m antenna	18.95
CA-3 Extra 220 flexible antenna	9.12
CA-4 Extra 440 flexible antenna	9.12
CP-1 Cigarette lighter receptacle chgr for BP-3	9.50
DC-1 DC operation module	17.50
HM-9 Speaker/microphone	34.50
LC-2A Leather case without TTP cutout	34.95
LC-2AT Leather case with TTP cutout	34.95
ML-1 2m 2.3/10w HT amp. (Reg. $89).. SALE	79.95
ML-25 2m 20w HT amp. (Reg. $199.50) SALE	179.95
IC-M12 12 ch Marine hand-held.. SPECIAL	$199.95

Misc. accessories:	Regular
24-PP 24-pin accessory plug	$ 4.00
BC-10A Memory back-up; 551/720/730/740	8.50
BC-20 Nicads & DC-DC charger for portables	57.50
BU-1 Memory back-up; 25A/290A/490A	38.50
EX-2 Relay box w/marker; 720A/730/701	34.00
HM-3 Deluxe mobile mic, specify radio	17.50
HM-5 Noise canx mobile microphone, 4 pin	34.50
HM-7 Amplified mobile microphone, 8 pin	29.00
HM-8 Touch-tone mic; 255A/260A, 8 pin	49.50
HM-10 Scan mic.; 255A/260A/290A/25A	39.50
HM-11 Scan mic.; 490/25A/290A	39.50
HM-14 Scanning/TTP mic; IC-25A/45A	49.50
SM-2 4-pin electret desk microphone; 551D	39.00
SM-5 8-pin electret desk mic.; 251A/451A	39.00
Mobile mount, specify radio	19.50
GC-4 World clock	99.95

MasterCard VISA

Order Toll Free: 1-800-558-0411

In Wisconsin (outside Milwaukee Metro Area) 1-800-242-5195

AMATEUR ELECTRONIC SUPPLY® Inc.

4828 W. Fond du Lac Avenue; Milwaukee, WI 53216 - Phone (414) 442-4200

AES BRANCH STORES — **Associate Store**

WICKLIFFE, Ohio 44092
28940 Euclid Avenue
Phone (216) 585-7388
Ohio WATS 1-800-362-0290
Outside Ohio 1-800-321-3594

ORLANDO, Fla. 32803
621 Commonwealth Ave
Phone (305) 894-3238
Fla. WATS 1-800-432-9424
Outside Florida 1-800-327-1917

CLEARWATER, Fla. 33575
1898 Drew Street
Phone (813) 461-4267
No In-State WATS
No Nationwide WATS

LAS VEGAS, Nev. 89106
1072 N. Rancho Drive
Phone (702) 647-3114
No In-State WATS
Outside Nevada 1-800-634-6227

CHICAGO, Illinois 60630
ERICKSON COMMUNICATIONS
5456 N. Milwaukee Avenue
Phone (312) 631-5181
15 min. from O'Hare!

into that bad habit you hear often from "Super Fists," those who send over their skills, make fumbles, then speed up still more. Almost always, they just make more and still more errors. You'll be much more successful by slowing down when you can't get your key away from stuttering. Then, after just a half-dozen more words or so, at a slower sending rate, you'll usually get your rhythm back. You'll regain your cool and reduce, sometimes even eliminate, your errors. And then you can start to increase your speed again.

7) *Make your on-the-air time important to you.* One member of the Monterey ham club told me, "Don't try to slip your QSOs in between your other scheduled chores. That will raise your tension level and can leave you with a bitter taste for CW." My experience confirms that advice. Turn on your station and operate your key when you're relaxed, confident, and ready. Consider your time on the air as something special—which, of course, it is.

Still, other hams turn to air-time when they are a bit uptight. They find relaxation in their QSOs. As in all these tips, select what's best for you. Try different tips and techniques. If they work for you, keep them; if they don't interface with your own interests or skills, forget them.

8) *Don't bother with stations which "don't sound right."* Earlier today I was on the air, searching. I heard a faint CQ, so faint I had to struggle to catch the call. "What the heck," I told myself, "give the guy a call—maybe he'll get stronger." Sometimes they do. And, of course, sometimes they get weaker. Then the contact may become frustrating for you. You may get more out of your hamming if you let doubtful calls go by.

Another example of contacts which don't sound right is the ham who fumbles his own call more than once or twice in a CQ. When there's apparently no other signal on the air, I sometimes figure, "Well, maybe he'll settle down once we make contact." Sometimes he does, indeed, become a textbook version of good sending. But often the errors just keep piling up. And I keep getting more and more uncool in trying to read him.

9) *Know how to tune up.* This is another elementary technique, yet from what I hear on the air, many hams with years of experience have still to learn how.

I'd read and believed all that literature that says, "Never tune up on the air." But some experienced operators told me, "You have to tune up on the air to make sure your swr is down where it should be." Finally, Tim Wheelis KQ6V, an Extra-class ham living in Pacific Grove, California, came to my shack and showed me just how to do it—*on my equipment.* My problem was that everyone who was telling me what I should do had gear that was different from mine. KQ6V has the same Heathkit equipment as I have. His tips were clear, specific, and relevant. They worked! So you, too, should avoid using tips about gear other than your own.

10) *Check the action on the other bands regularly.* I make it a practice to do that about every hour I'm on the air—after about every two contacts. I might be happy with plenty of contacts on 15 meters, for example, but I want to be there when 10 opens!

11) *Learn to live with QRM and QRN.* A friend of mine, a non-ham, visiting my shack heard the Russian woodpecker. You may not have met that bird yet. It's a loud, harsh, steady, persistent pecking sound. It comes from some Soviet electronics project and is not intentional interference, I'm told. It may last just a few seconds, yet other times it may go on for an hour or longer. Sometimes it settles on just a small part of a band; other times it will range up and down quite an expanse of frequencies. On hearing that horrible sound, my friend asked, "Is he paid by the makers of headache pills?" I doubt that. Still, you should learn to live with it, and with other interferences, static, and distractions. Don't become one of those operators who CWs "I must QRT (stop sending)" as soon as listening gets a bit difficult. Try a bit harder and a bit longer when rough stuff gets on the air, and you'll soon find you can copy through a lot more QRM and QRN than you might have thought.

There, then, are tips and techniques which can help every Novice fill up his or her logs faster than ever. And for you old hands, reviewing such basics just might get you, too, into stations you've never reached before. ■

Beginning operators, until they get a fair number of QSOs, often find it hard to think up the words to use and then spell them. To help solve such problems, I refer to a notecard prepared with key phrases on it.

Photos by Steven Ybarrola

Novice or experienced: Please send me the tips you've discovered, the techniques you use to improve your on-the-air skills. Include your call, name, and QTH so you might be mentioned in a future article rounding up still more specifics.

step up to the best...

Without doubt LR-1 is the repeater value leader! Compare its outstanding performance with any repeater -- then look at its price. LR-1 features include individual die-cast shielding of receiver and transmitter plus a separately shielded 6-stage receiver prefilter for peak performance in harsh RF environments • Front panel metering of all vital functions • CW identifier • Symmetric hard limiting for clean natural audio • Low power MOS control logic • Even the cabinet is included -- just plug in and go!

NEW

LINKING? The LR-1 is also available with control circuitry for Link Transceiver operation. Now link repeater sites with the flexible control capability you've always wanted.

HIGH POWER? Our PA-75 power amplifier is the champion! Ruggedly built to give years of dependable operation in continuous duty repeater service.

NEW

Mark 3C repeaters and controllers have no equal in performance. Both units feature auto patch, reverse autopatch, autodial, 13 Morse messages and a total of 39 functions. Both feature microprocessor control and both have been proven in the field from icy Alaska to tropical Brazil. A Mark 3C supercontroller can make any repeater a super performer. The Mark 3CR repeater is in a class by itself. It combines superbly designed RF circuitry in one handsome package. It is without doubt the world's most advanced repeater!

CALL OR WRITE FOR FULL DETAILS

MICRO CONTROL SPECIALTIES

49

23 Elm Park • Groveland, Massachusetts 01834 • Telephone (617) 372-3442

See List of Advertisers on page 114

Gary Bischoff KB2GA
1358 C. Hommel Road
Saugerties NY 12477

Home-Brew an Apple Computer—and Save!

In this 73 exclusive, KB2GA reveals the secrets of Apple construction. From keyboard to motherboard, it's all here.*

Photos by KB2GA

Component	European Quantity	Domestic Quantity
555	2	2
558	1	1
741	1	1
2513	1	1
Character Generator	0	1
6502	1	1
9334	0	1
8304	0	1
8T28	2	0
8T97	3	3
74166	2	1
74LS00	1	1
74LS02	3	4
74LS04	1	1
74LS08	2	2
74LS11	1	1
74LS20	1	1
74LS32	3	1
74LS51	1	1
74LS74	2	3
74LS138	4	4
74LS139	1	1
74LS151	0	1
74LS153	4	4
74LS157	1	0
74LS161	4	4
74LS174	2	2
74LS194	2	3
74LS251	1	1
74LS257	5	5
74LS259	1	0
74LS283	1	1
74S74	1	0
74S86	1	1
74S151	1	0
74S175	2	1
74S195	1	1
4116 (RAM) (48K)	24	24
ROM Set	4	4

Table 1. Apple integrated circuit list.

Lately, many amateurs have been using personal computers in the shack. There have been many fine articles in amateur publications describing some of the uses of home computers as a valuable station accessory.[1,2,3,4,5]

This article will describe a method of obtaining an equivalent to one of the better computers on the market today at a cost well below the normal price. Enough information will be presented to enable you to obtain parts and then build and test a computer using a preassembled board.

System Features

There are many variables that should be considered when selecting a microcomputer system. We can oversimplify a bit and say that the two most important considerations are functionality and price. Or, how can we get the most bang for the buck?

As with other station accessories, we could consider building a computer. There are many articles about how to make a small computer using various microprocessors, but after all the effort of gathering parts, wiring, assembly, and testing, you may be left with a system that has no readily-available software and is without a lot of flexibility.

An easier way is to obtain an assembled board for one of the more popular computers. There are motherboards available for the Apple II computer from legitimate sources.[6,7] Since the entire computer is on a single board, connecting the power supplies, an ASCII keyboard, and a monitor results in an operational system. An ordinary tape recorder can be used to store programs.

Other than the obvious cost savings, there are other advantages to doing it yourself. First, you will have an understanding of what is inside the system should it ever need service. Second, the package can be made more RFI tight than the factory model. All computers generate a certain amount of rf, and when you are trying to pull in a rare DX station out of the mud, each dB of attenuation around your computer (the rf generator) is important. Third, the package can be customized

*Apple is a registered trademark of Apple Computer, Inc.

to your particular liking. (Three possibilities are rack mounted, table top, or a portable package.) You may even want to leave room for interface circuitry such as a keyer or RTTY. Also, there is the pride and satisfaction of doing it yourself.

Before getting into the actual construction, let's consider some of the advantages/disadvantages of an Apple compared to some of the other personal computers on the market today. The large base of Apples that have been sold means that there is a lot of good software written for it. Application software is available through local users' groups, computer stores, and via mail order from many vendors. The Apple documentation is well written, informative, and easily available. That is important for a project like this.

The graphics capability is very good—at least as good as the other machines in its price class. With the addition of a disk drive and a printer, you could have the makings of a small business system capable of being used for such things as inventory, accounting, tax preparation, and other functions. A word-processing system is one of the most useful applications for a home computer, and you may find yourself waiting in line to update your logs as one of the junior ops finishes a book report. And don't forget the inevitable and captivating video games.

Construction

Obviously, the first step in this project is to obtain a motherboard. The boards are available in three different configurations: a bare board, an assembled European version, and an assembled domestic board.[6,7] Assembled and tested boards can usually be obtained for $350 to $450. The bare board typically sells for $100 to $200.

Photo A. Front view of the case with the system in operation. The hole pattern to the right of the disk drive is for the speaker.

The bare board requires installation of the sockets, I/O (input/output) connectors, discrete circuitry, and, of course, the integrated circuits. The integrated circuits (ICs) required are a 6502 microprocessor, support ICs—mostly 74LS series—and the Apple ROMs (read-only memories) which contain the Basic program and the monitor. Table 1 shows the required integrated circuits.

With the available documentation, assembling a bare board is not much harder than building a kit. (However, I would not recommend the approach for anyone without some experience with digital circuits.) All the IC locations and types are silk-screened on the top of the board, along with the discrete component values. The schematic for the domestic board is in the Apple II *Reference Manual*. This book is highly recommended for all Apple users and is mandatory if building is contemplated. The *Reference Manual* is published by Apple Computer Inc., Cupertino, California (Apple Product #2L0001A).

This book and the Apple ROMs are available from your local Apple dealer (the ROMs must be ordered specially by most dealers). The books and ROMs are available via mail from Applied Invention.[8] Electrovalue[6] also sells the entire integrated circuit package (minus the ROMs) for $60.00 to $75.00 depending on the board configuration. They also have packages that include connectors, the crystal, speaker, etc. Another good source for ROMs and other Apple ICs and manuals is Component Sales.[13] A set of four ROMs (Integer Basic version) can be obtained for $35.00 to $45.00.

The European version of the Apple board can be used without modification except for the high-resolution-graphics mode. This version sells for less than the domestic version and may be easier to find. If you are interested in the hi-res

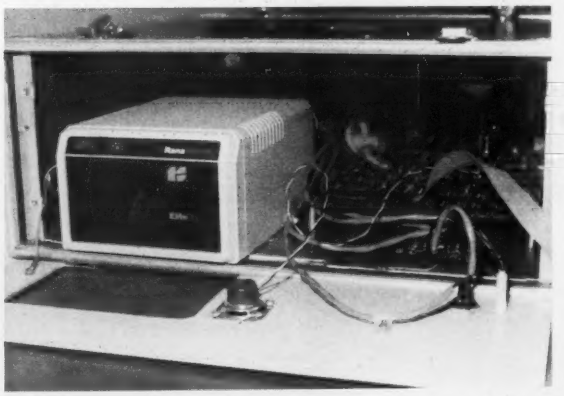


Photo B. Front of the case with the cover removed. Note the position of the disk drive and the motherboard. The terminal strip on the right is for distribution of the ac power. The copper-clad printed-circuit material can also be seen.

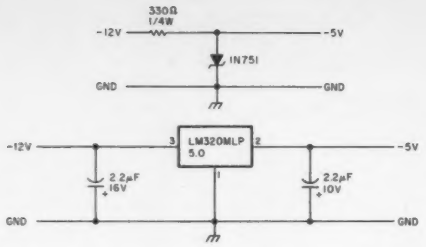


Fig. 1. −5-volt power supply with zener diode (top) or 3-terminal regulator.

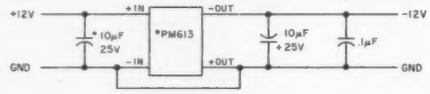


*Fig. 2. Typical circuit for generating −12-volt supply using dc-to-dc converter. (*Available from Power Products, 1400 N.W. 70th St., Fort Lauderdale FL 33309.)*

graphics, modifications can be made. This requires about twenty cuts to the printed circuit board and a similar number of jumpers to be added. Specific instructions for this modification are available from the vendor. (Again, you should have some experience before attempting the modifications.) Without making the modifications, the board is still usable for most applications. Note: If a European board is obtained, test the board for operation in Basic and low-resolution graphics before making the modifications for hi-res.

If you obtain an assembled and tested domestic version, connect the correct power supplies and a monitor and you will be "on line."

Power Supplies

The standard Apple uses a switching power supply. This supply as well as other switching supplies are available from various vendors.[6] Other than the disadvantage of taking more space and some more power, linear supplies are perfectly acceptable. They are more readily available and have less high-frequency noise on the output than the switchers.

Table 2 lists the voltages and current requirements for the supplies as well as a typical commercial supply. There have been a lot of articles in this magazine covering the design and fabrication of 12-volt regulated supplies for use with mobile 2-meter equipment, and also articles describing 5-volt logic supplies. Also check your local surplus outlet; I was fortunate enough to find suitable 12- and 5-volt supplies.

Another good source of reasonably-priced supplies is Jameco Electronics, 1355 Shoreway Rd., Belmont, California 94002; (415)-592-8097.

If you are contemplating adding expansion boards and other circuitry, consider using supplies with extra current capability. A word of caution: Linear supplies with more current capability can be used, but beware of multiple-output switching supplies with more capacity than needed. Some models require a certain minimum load on one or more outputs to operate correctly.

The power supplies get connected to the motherboard using a six-pin connector. The connector is an Amp #9-35028-1. The connector is available from Electrovalue or can be ordered specially by your local Apple dealer. If you can't wait for the Amp connector, solder six wires to the back of the board and put another connector between the supplies and the board. I used a Cinch six-prong connector pair. The connector coming from the board should be the male. The connector is wired as follows:

Pin	Function
1	GND
2	GND
3	+5 V
4	+12 V
5	−12 V
6	−5 V

Since the −5-volt supply requires very little current, it can be generated from the −12-volt supply using either a zener diode or a three-terminal regulator as shown in Figs. 1(a) and 1(b).

The −12-volt supply can be obtained with a line-operated regulator, but low-current supplies are not as common as the higher current models. Look for dual-output +5- and −12-volt units. Another alternative is to generate the −12 from the +12 or +5 volts using a dc-to-dc converter. A schematic for a typical circuit is shown in Fig. 2. The device specified is capable of supplying 80 mA, so caution should be used if the system is expanded using function cards.

Several alternative methods have been presented to obtain the necessary power; the choice depends essentially on what is available or can be obtained easily.

Keyboard

Almost any ASCII (American Standard Code for Information Interchange)-encoded keyboard can be used. Keyboards can be obtained from several supply houses.[6] The keyboard must be wired into a sixteen-pin DIP connector. The pinout is shown in Table 3.

Some older keyboards have inverted outputs. The Apple board looks for a high output when the data is true. For example, when the B key is pressed, the output should be 1000011—where a zero (0) is ground and a one (1) is 3 to 5 volts. If necessary, two hex inverter chips can be used to convert a negative-output keyboard into an Apple-compatible unit. A schematic for an inverter circuit is shown in Fig. 3.

Monitor

Some type of video display is necessary to interface with the Apple. There are several alternatives. A surplus monitor would cost some $25.00 to $100. A

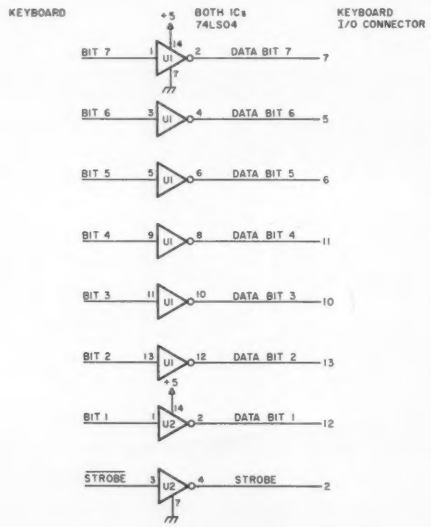


Fig. 3. Inverter circuit schematic.

Connect your computer to the air!

The "AIRWAVES" that is, thru the Microlog AIR-1, a single board terminal unit AND operating program that needs no external power supply or dangling extras to put your VIC-20 computer on CW & RTTY. And what a program! The famous Microlog CW decoding algorithms, superior computer enhanced RTTY detection, all the features that have made Microlog terminals the standard by which others are compared. Convenient plug-in jacks make connection to your radio a snap. On screen tuning indicator and audio reference tone make it easy to use. The simple, one board design makes it inexpensive. And Microlog know-how makes it best!

There's nothing left out with the AIR-1. Your VIC-20, America's most popular computer, can team-up with Microlog, America's most successful HAM terminal, to give you an unbeatable price and performance combination for RTTY & CW. If you've been waiting for the right system at the right price, or you've been disappointed with previous operating programs, your time is now. At $199, the complete AIR-1 is your answer. Join the silent revolution in RTTY/CW and put your VIC-20 ON-THE-AIR! See it at your local dealer or give us a call at Microlog Corporation, 18713 Mooney Drive, Gaithersburg, Maryland. TEL (301) 258 8400. TELEX 908153.

Note: VIC-20 is a trademark of Commodore Electronics, Ltd.

MICROLOG ✓51

INNOVATORS IN DIGITAL COMMUNICATION

black and white TV could run from no cost to $90.00. A new monitor is around $100 to $150. A portable color TV will cost $100 to $400. A color monitor runs from $300 to $500.

Monitors can be found on the surplus market. Most of these will be black and white. Any monitor compatible with the Electronic Industries Association (EIA) and National Television Standards Committee (NTSC) standard will work. A one-volt (adjustable) composite color video signal is available at the rear of the board. This signal can be fed to the monitor via a cable, usually with two RCA-type jacks.

The new monitors on the market today are usually green on black and are much easier on the eyes than the black-and-white versions. The graphics displays also are much more vivid. These can be obtained from most computer supply outlets.[9]

A regular television set is suitable for use as a monitor. Since the Apple can generate color graphics, many users prefer a color TV. The display on a TV is not as sharp and crisp as a monitor. Of course, with a TV you can disconnect the computer and watch Mork and Mindy or Laverne and Shirley. (Note: Some may consider that feature a disadvantage.)

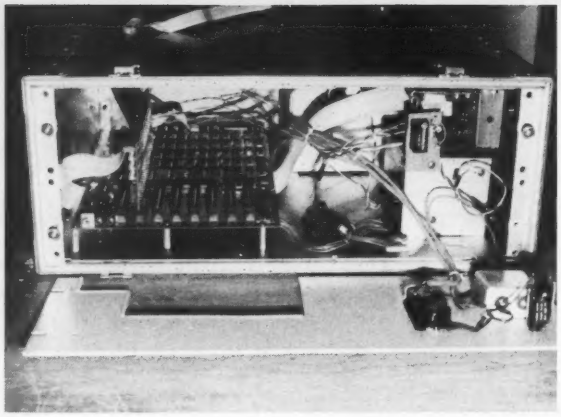


Photo C. The case with the rear panel removed. The motherboard is on the left, and the expansion connectors for peripheral cards can be seen. The power supplies are on the right; the supply mounted to the bottom is +12 V at 1.5 A, and the supply mounted above and to the upper right of the case is the +5-volt supply. The dc-to-dc converter circuit for the −12 is shown mounted to the case of the +12 supply. The components on the right are a line filter, circuit breaker, and an ac line outlet.

An rf modulator must be used between the computer output and the TV. The composite video signal modulates the output of the modulator in one of the two lower VHF television bands: 61.25 MHz (channel 3) or 67.25 MHz (channel 4). Modulators are available from your local computer dealer or Radio Shack (part #277-221).

The best monitor, and naturally the most expensive, is a color monitor designed for computer use. The display is clear and sharp like the monochrome monitors and the colors are vivid. The resulting color graphics are superior to those produced on a color TV.

Choosing the monitor is mostly a matter of taste and the thickness of one's wallet. It is easiest to start with a system using any available TV and then upgrade at a later date.

System Test

Before putting the system in a package, it is best to test it on a bench. Assuming an assembled motherboard is available, connect the power supplies as described earlier. Double-check the wiring before turning on the supplies. Connect a known good monitor or TV as described. Note that we do not connect the keyboard yet.

Now for the first test. Turn on the power to the TV or monitor, and then the system supplies. The screen should be filled with a bunch of random characters, letters, numbers, question marks, anything. This is the random turn-on pattern of what is in the screen-display memory. At the bottom left of the screen should be an asterisk. If all is well, skip the next three paragraphs.

If the screen does not show random characters, turn off the power supplies and check the connections and output voltages again. If everything is OK, turn on the power to the board. Check the power to the board by measuring the voltages on the board with respect to power ground. Check for obvious faults such as bent IC pins, shorts, loose components, etc. If there are no mechanical problems and the power is correct, make sure that your monitor or modulator and TV and connecting cables are operational by hooking them up to a friend's computer. (It is not necessary to use an Apple; several other systems use a video output.)

Voltage	Apple Supply Capability	Actual Required (System 1)	Current Required (System 2)	Recommended Supply
+5V	2.5 Amp	1.5 Amp	1.8 Amp	Power/Mate EM-5B or equiv. 5 V at 3 A
−5V	250 mA	10 mA	12 mA	See text
+12V	1.5 Amp	400 mA	1.2 Amp	Power/Mate EM-12B or equiv. 12 V at 1.5 A
−12V	250 mA	15 mA	80 mA	Power/Mate MM-12A or equiv. 12 V at 100 mA

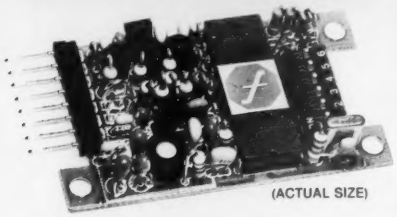
Notes: (1) System 1—48K Apple with no peripherals.
(2) System 2—64K Apple with disk drive and controller, printer interface, and a 16K RAM card.
(3) Power/Mate Corp., 514 S. River St., Hackensack NJ 07601; (201)-440-3100. Will sell small orders.

Table 2. Voltage and current requirements.

Pin	Function	Notes
1	+5 V	Power supply to keyboard (120 mA max)
2	Strobe	From keyboard, 10 microsec min
3	Reset	From keyboard, shorted to GND when reset
4	No connection	
5	Data 5	Part of seven-bit ASCII output
6	Data 4	Ditto
7	Data 6	Ditto
8	Ground	System electrical ground (GND)
9	No connection	
10	Data 2	ASCII output
11	Data 3	Ditto
12	Data 0	Ditto
14	No connection	
15	−12 V	Power supply to keyboard
16	No connection	

Table 3. Keyboard connector pinout.

PROGRAMMABLE
CTCSS ENCODER/DECODER



(ACTUAL SIZE)

- All 37 EIA Tones
- Quartz Accurate
- Universal

$54.95

IMMEDIATE DELIVERY AVAILABLE
FROM NEW YORK AND CALIFORNIA
DISTRIBUTION CENTERS

For more information call TOLL-FREE
(800) 828-6884
NY: (800) 462-7242
CANADA: (416) 884-3180 ↙218

FERRITRONICS *MOBILE DATA SYSTEMS*
1319 PINE AVE.
NIAGARA FALLS NY 14301

★RTTY★RTTY★RTTY★RTTY★RTTY★

BUILT TO WORK WHEN OTHERS WON'T!

TMC-1B Computer Interface for RTTY/CW

The **best performing unit** under adverse band conditions, **TMC-1B** is designed to compare with the professional equipment that has been on the market for years, not just a piece of gear to get you into computer RTTY. No computer experience needed. Software is included for Vic-20. Will work with most micro computers and with most of the popular software available. Only **CTI** gives you all this and more ★ **Auto start** with a variable control on front panel, will only print on properly tuned RTTY signal ★ L C tuned circuit filters (no active filters) ★ Easy to tune with large meter for greater accuracy, also mark and space LEDs ★ Switchable between 2 rigs (no wires to change) ★ Built-in monitor speaker for monitoring the signal as you send it ★ High gain on input, turn your rig way down ★ Relay isolated CW key and P.T.T. ★ Simple hook-up ★ RS 232 ★ All metal cabinet ★ One year guarantee. **$299.95**

Price includes Vic-20 software in basic on cassette and computer cable

MasterCard VISA

Write or call for more information:

CONTEMPORARY TECHNOLOGY, INC.
P.O. BOX 1083 • SALEM, OR. 97308 ↙37
503 - 399-7406

★RTTY★RTTY★RTTY★RTTY★RTTY★

ONLY FROM ELECTRONIC RAINBOW

$485.00

LIQUID CRYSTAL 1 GHz FREQUENCY COUNTER

- ★ .75″ 9 Digit L.C.D. Display
- ★ 24 Hr Clock Hr.-Min.-Sec.
- ★ 10 Min. Timer with warning tone
- ★ Low-Low sensitivity less than 15 Mv from 10 Hz to 1 GHz
- ★ 4 Gate Times .5, 5., 1., 10. Sec.
- ★ Resolution: .1 Hz to 20 MHz 10Hz to 1 GHz
- ★ Time Base: .1 PPM TCXO Standard (10 MHz Crystal)
- ★ Push Button simplicity
- ★ Liquid Crystal Easy to read in direct sunlight
- ★ Size 11¼″ W x 4″ H x 8¼″ D

OPTIONS:

- ★ Internal battery source available
- ★ .01 Crystal oven timebase available

100% Parts and Labor guarantee for 1 year

DEALER INQUIRIES INVITED

To order by Visa or Master Charge
No C.O.D. orders
Call 800-428-3500
Information 317-291-7262
6254 La Pas Trail
Indianapolis, Indiana 46268

ELECTRONIC RAINBOW INC ↙58

↙See List of Advertisers on page 114

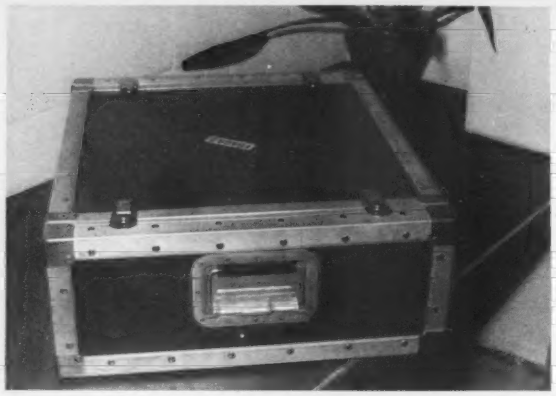


Photo D. This photograph shows the case buttoned up, ready for travel.

Photo E. The benchtop wooden "enclosure" described in the text.

If the problem still persists after the above tests, suspect a bad IC. The solution to this problem is substitution. You will need either a known good Apple from which you can substitute ICs one at a time or an extra set of components. Another troubleshooting step is to put the board into a known good Apple and try it out.

To narrow down the possible IC faults to some degree, try the following substitutions. If nothing appears on the screen, something is wrong with the clock-divider chain. Check B1, B2, C1, C2, and D11 through D14. Also check the video-generator section, A3, A5, A8, A9, A10, B4, B8, B9, and B10. If the screen is covered by a block pattern which changes in a random fashion each time power is turned on, a data line or memory chip is probably bad. Check the first memory bank, C3 through C10, and the memory data latches, B5 and B8. Check the RAM address multiplexer, C12, E11, E12, E13, and E14. Verify that the RAM select chips, C1, C12, E2, F2, and J1, are operational.

If the monitor comes up with a random character pattern, it indicates that the CPU is working, the clock gets divided down correctly, the address and data lines work, and so on. Turn the power off and connect the keyboard. Turn the power on and in response to the asterisk prompt, type a Control B. The unit will come up in Basic. If the ROM contains Integer Basic, a > sign will appear. For units with floating-point Applesoft Basic, a] prompt will appear. Once this happens, you probably have a working system. Write a small test program to further verify operation.

There are several books on Basic. The Apple II *User's Guide*[11] is an excellent reference which also covers other topics of interest such as differences between the two Apple Basics, hardware interface, etc.

To store programs for later use, some type of magnetic storage medium is required. An ordinary cassette tape recorder can be used for program storage and also can serve as a way of using commercially-available software. The Apple II *Reference Manual* describes the interface and operation.

The first peripheral to consider should be a disk drive. After working with cassettes, the convenience of a disk drive will be appreciated. Disk drives and controllers are available from several sources including Applied Invention.[8]

Packaging

As we briefly discussed earlier, there are several different ways in which a unit such as this could be packaged. I was fortunate enough to obtain at a reasonable price the case shown in the photographs. The case is open only at the back and front so that access to the board and power supplies is limited, but it is sturdy and portable. Snapping on the front and rear covers completely closes the case and provides a carrying handle.

A few trips to the local surplus outlets might turn up a similar bargain. Unlike most Apple installations, I chose to have the disk built in rather than sitting on top of the box. Using a hacksaw, I cut an opening in the front

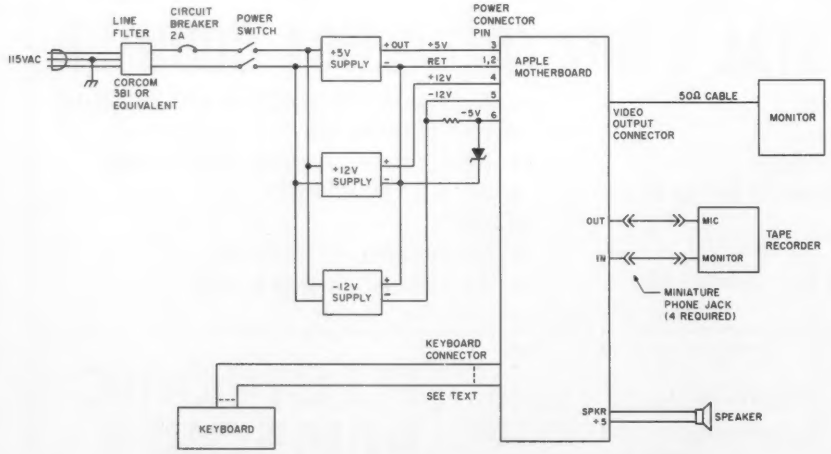


Fig. 4. Interconnection diagram.

Since 1966, HEIL, LTD. has built sound systems for groups such as the WHO, STONES, DOLLY PARTON and recording studios. HEIL now directs their expertise to the amateur radio field.

MICROPHONE EQUALIZER

$49.95 add $3.00 shipping

- High quality speech audio
- Increase talk power, 10dB!
- Equalize any microphone
- Be proud of your signal
- Installs easily in mic lead
- Brighten up MC-50 mics
- Put good lows in D-104

MODEL EQ 200

Most signals contain excessive lows, very few highs that cause them to be muddy sounding, hard to copy, lacking articulation and prescence of sibilance (S & T sounds). These annoying conditions are NOT solved by audio processing. The answer is EQUALIZATION. Just as broadcasters and recording studios EQ their mic lines, the EQ 200 allows you to reduce distortion, add clearity, prescence and sibilance.

The card also has a Two Tone Generator circuit. By installing a few components, you can properly tune your SSB transmitter. Two Tone parts Kit $7.00

HEIL, LTD.
Marissa, IL 62257
618-295-3000

✓59

AZDEN

PCS-300	142-150MHZ 3W 8 MEM.HANDHELD	265.95
PCS-4000	142-150MHZ 25W 16 MEM.MOBILE	265.95

BUTTERNUT ANTENNAS

2MCV	2 METER TROMBONE..5/8 WAVE	29.95
2MCV-S	2 METER SUPER TROMBONE	34.50
HF6V	10-80M & 6M TRAP VERTICAL	106.75
HF6VX	AS ABOVE IN SMALLER BOX	122.00
TBR-160	160 METER ADD ON KIT FOR HF6V.	45.00

CUSHCRAFT

22-19	144-148MHZ 19 ELEMENT BEAM	88.41
AV-4	10,15,20,40M TRAP VERTICAL	88.41
AV-5	10,15,20,40,80M TRAP VERTICAL	95.00
10-3CD	10M 3 ELEMENT SKY WALKER BEAM.	88.00
15-3CD	15M 3 ELEMENT SKY WALKER BEAM.	108.85
15-4CD	15M 4 ELEMENT SKY WALKER BEAM.	115.65
20-3CD	20M 3 ELEMENT SKY WALKER BEAM.	184.00
20-4CD	20M 4 ELEMENT SKY WALKER BEAM.	258.50
40-2CD	40M 2 ELEMENT SKY WALKER BEAM.	272.00
AMS-147	146-148MHZ MOBILE MAGNET MOUNT.	27.95
ATS-147	146-148MHZ MOBILE TRUNK MOUNT.	27.95
A147-11	146-148MHZ 11 ELEMENT BEAM	44.25
A147-20T	144&147 MHZ 20 ELEMENT BEAM	81.65
ARX2B	134-164MHZ RINGO RANGER II	34.00
A144-11	144MHZ 11 ELEMENT BEAM	44.25
A144-10T	145 MHZ 10 ELEMENT TWIST BEAM.	47.60
A144-20T	145 MHZ 20 ELEMENT TWIST BEAM.	68.00
214B	146-148MHZ 14 ELEMENT BEAM	74.80
214FB	144.5-148MHZ 14 ELEMENT BEAM.	74.80

CALL FOR PRICES ON OTHER CUSHCRAFT PRODUCTS

DAIWA/MILLER

CS-201	2 POS. HEAVY DUTY COAX SWITCH.	19.85
CS-401	4 POS. HEAVY DUTY COAX SWITCH.	61.25
CN-520	1.8-60MHZ SWR/POWER METER	58.95
CN-620B	1.8-150 MHZ SWR/POWER METER.	105.00
CN-630	140-450MHZ SWR/POWER METER.	121.00
CN-720B	1.8-150 MHZ SWR/POWER METER.	145.00
CNA1001	10-80M AUTOMATIC ANT. TUNER.	295.00

ROTORS & CABLES

HD-73	ALLIANCE HEAVY DUTY ROTOR	89.00
U100	ALLIANCE LIGHT DUTY ROTOR	42.00
HDR-300	HYGAIN SUPER HEAVY DUTY ROTOR	425.00
8610	8 CONDUCTOR ROTOR CABLE..PER FT.	0.17
9091	MINI RG8 (RG8X)..PER FT.	0.16
9095-100	RG8U SUPERFLEX W/PL-259 100FT.	29.85
4063	RG-213 MIL-SPEC COAX.....PER FT.	0.28

HY-GAIN

TH7DXS	10,15,20M 7 ELEMENT BEAM	335.00
TH3JRS	10,15,20M 3 ELEMENT BEAM	140.00
HQ-2	10,15,20M 2 ELEMENT QUAD	259.00
V2-S	2M 5/8 WAVE 3DB GAIN COLLINEAR.	34.00
66-BS	6M 6 ELEMENT BEAM	106.00
5DBQ	10-80M TRAP DOUBLET	104.00

KDK 2 METER RADIOS

FM-2030	143-149MHZ 25W 11 MEMORY	265.95

MINI-PRODUCTS

HQ-1	6,10,15,20M MINI QUAD	129.50

MACO POWER SUPPLIES

2006	8AMP SURGE, 6AMP INT., 4AMP CONT.	46.00
2010	12AMP SURGE,10AMP INT., 8AMP CONT.	55.25
2020	24AMP SURGE,20AMP INT.,12AMP CONT.	69.00
2030	36AMP SURGE,30AMP INT.,18AMP CONT.	100.00

MFJ PRODUCTS

MFJ-103	12/24 HOUR CLOCK	31.45
MFJ-202	RF NOISE BRIDGE	51.00
MFJ-262	1000W DRY DUMMY LOAD	55.00
MFJ-311	154-158MHZ CONV.FOR 2M SYN.	41.95
MFJ-481	50 CHARACTER MEMORY KEYER	76.00
MFJ-494	SUPER KEYBOARD 50 CHAR.MEMORY	255.00
MFJ-496	AS ABOVE WITH 250 CHAR.MEMORY	285.00
MFJ-722	SUPER SSB/CW FILTER	58.75
MFJ-941C	ANTENNA TUNER/SWR METER 1:4BAL.	75.50
MFJ-989	3KW ANTENNA TUNER LOADMP	277.00
MFJ-16010	RANDOM WIRE TUNER	33.50

CALL FOR PRICES ON OTHER MFJ PRODUCTS

MIRAGE AMPLIFIERS

B23	2M FM/SSB/CW 2 IN 30 OUT	75.50
B108	2M FM/SSB/CW 10 IN 80 OUT	151.00
B1016	2M FM/SSB/CW 10 IN 160 OUT	235.00
B3016	2M FM/SSB/CW 30 IN 160 OUT	301.65
D1010	430-450MHZ 10 IN 100 OUT	275.95
MP1	1.8-30MHZ SWR/WATT METER	100.00
MP2	50-200MHZ SWR/WATT METER	100.00

TEMPO RADIOS & AMPS

**********	SUPER SPECIAL **********	
S-1	144-148MHZ 1.5W HANDHELD	239.95
S-1T	S-1 WITH 12 KEY TONE PAD	289.95
PRICE ON	S-1 & S-1T INCLUDE 5/8 WAVE SUPER	
STICK II & RUBBER DUCK WHILE SUPPLY LASTS		
**********		
S-15	140-150MHZ 5W 3 MEM.HANDHELD	255.00
S-15B	150-160MHZ EXPORT MODEL	307.00
S-15T	S-15 WITH 16 KEY TONE PAD	274.00
S-15TB	S-15B WITH 16 KEY TONE PAD	322.50
ACH-15	AC QUICK CHARGER FOR S-15	52.90
CC-15	LEATHER CASE FOR S-15	22.50
BP-15	SPARE BATTERY FOR S-15	25.75
HM-15	SPEAKER MIKE FOR S-15	30.50
S-30	30 WATT AMP FOR 2M HANDHELDS	80.50
S-80	80 WATT AMP FOR 2M HANDHELDS	135.00

TEN-TEC

ARGOSY	10M/100W SSB/CW 10-80M W/30M	510.00
CORSAIR	200W SSB/CW 10-160M W/WARC	999.00
HERCULES	1KW AMP WITH 115/230 VAC P/S	1595.00

VOCOM PRODUCTS

2C025-2W	2M FM AMP 2 IN 25 OUT	65.00
2C050-2W	2M FM AMP 2 IN 50 OUT	96.00
2C100-2W	2M FM AMP 2 IN 100 OUT	154.00

WILSON BY MACO

SY-33	10,15,20M 3 ELEMENT BEAM	194.00
SY-56	10,15,20M 6 ELEMENT BEAM	259.00
33-6MK	40 METER ADD ON FOR ABOVE	67.95
WV-1A	10-40M TRAP VERTICAL	69.00
GR-1	GROUND RADIAL KIT FOR WV-1A	27.00

Amateur Communications Etc.

COD Available

Hours: 8:30 a.m. to 5:00 p.m. Monday thru Friday
9:00 a.m. to 2:00 p.m. Saturday - CST
Prices subject to change without notice.

CALL FOR QUOTES ON OTHER RELATED PRODUCTS FOB ORIGIN

Amateur Equipment, Accessories & Antennas. Export Anywhere

2317 Vance Jackson Rd.
San Antonio TX 78213

(512) 733-0334

(Toll free number 800-531-5405)

NOW!

a 30 watt amplifier that also CHARGES!

35 mA rate recharges your handheld when it's off, maintains charge in the receive mode.

And it adds 30 watts of mobile talk-out power; makes an incredible performer of your HT-based mobile radio system.

All at the price of an amplifier alone! An incredible value.

Only $74.95! Order today. Call toll-free

1-800-USA-MADE

Charge VISA, MC or mail check, money order. Add $3.00 for shipping; Illinois residents also add $4.50 sales tax.

VoCom
PRODUCTS CORPORATION
65 East Palatine Road
Prospect Heights, IL 60070
(312) 459-3680

✓90

✓See List of Advertisers on page 114

panel for the front of the drive as shown in Photo A. The drive is screwed to the bottom of the case.

Since the case is not metal, I also took the extra precaution of covering the entire inside with double-sided copper-clad PC-board material. All the separate sheets of material are electrically tied together using solder and ground braid. This proved to be a considerable help in curing the TV interference caused by the system.

If the unit is going to stay in one location, consider the approach taken by Jules Madey K2KGJ. Photo E shows this packaging scheme. The motherboard sits on the bench and is covered by an inverted U-shaped wood structure. The wood cover supports the monitor, disk drives and various interface circuitry. The power supplies are mounted below the bench and connected via a cable. The keyboard is mounted in another wood box in front of the system. Everything in the system is very accessible, and the packaging can easily be finished in one evening. This method could also serve as an interim package until a suitable case could be located.

Some manufacturers have cases available with sloping fronts. With the larger models, the motherboard and power supplies could be mounted on the bottom and the keyboard fastened to the sloping front through an appropriate cutout. The keyboard would then be at the correct angle for typing. This package would be very similar to a factory-built Apple. Two companies that make that type of enclosure are Buckeye Stamping Co.[11] and Hammond Manufacturing.[12] (Ask for the "Desk Top Consoles" catalog from Hammond.)

Suitable cases and enclosures show up at hamfests and surplus houses, so keep your eyes open.

Conclusion

This article presented some ideas, thoughts, and actual hardware implementations of home-built computers. The techniques used by most of the manufacturers is to put everything on one board. These boards are sold also to OEM manufacturers for use in computer-based products. This makes full-function computers available if one does a little digging. Most of what was discussed here can be applied to computers other than the Apple. I hope this article inspires some other home-built computers. ■

References

1. C. Papas, "Got an Apple? Want RTTY?", *73*, October, 1982.

2. M. Richardson, "CW and the Apple II," *73*, November, 1982.

3. T. Johnson, "OSCAR Pathfinder," *73*, March, 1982.

4. P. Zander, "Computerized Contest Duplicate Checking," *QST*, June, 1981.

5. G. Vatt, "Computer-Aided UHF Preamplifier Design," *Ham Radio*, October, 1982.

6. Electrovalue Industrial Inc., PO Box 157-F, Morris Plains NJ 07950; (201)-267-1117.

7. XICOM, 801 E. Ogden Ave., Suite 1085, Naperville IL 60566; (312)-369-6125.

8. Applied Invention, RD2 Rt 21, Hillsdale NY 12529; (518)-325-3911.

9. Electronics for Communications, 1358 C. Hommel Rd., Saugerties NY 12477; (914)-246-6858.

10. L. Poole, M. McNiff, and S. Cook, *Apple II User's Guide*, Osborne/McGraw-Hill, 1981.

11. The Buckeye Stamping Co., 555 Marion Rd., Columbus OH 43207; (614)-445-8433.

12. Hammond Manufacturing Co., 1690 Walden Ave., Buffalo NY 14225; (716)-894-5710.

13. Component Sales Inc., 778A Brannan St., San Francisco CA 94103; (415)-861-1345.

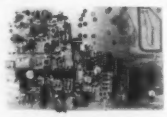
PROJECTPACKS

BASED ON THE BRITISH PUBLICATION—RADIO & ELECTRONICS WORLD

SYNTHESIZED AIRBAND RECEIVER

720 Channels (thumb-wheel switches)
118 MHz to 136 MHz
25 KHz channels
Built in AC Power Supply
Provision for 12v battery use-low drain
CMOS Motorola Synthesizer Chip
Good dynamic range
Kit includes PCBoard, all components and hardware (enclosure and speaker not included).

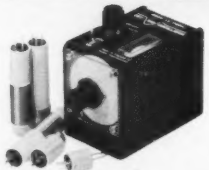
Stock No. 40-72001 **$162.50***



AIRBAND MEMORY

Memory add-on for synthesized airband receiver.
160 Memory channels with battery data retention.
LED Channel readout
Kit includes PCB, all components, NiCad battery, and rotary code switch.

Stock No. 41-00303 **$49.95***



FET DIP OSCILLATOR

(a must for the serious RF experimenter)

Checks resonant frequency of tuned circuits. A signal source for adjusting circuits. Marker generator companion for a sweep generator. An absorption wave meter.

Specifications:
1.6–215 MHz
5 ranges
self-contained, 9v battery
Meter and audio (piezo buzzer) dip indication

Kit includes PCBoard, all components and hardware punched, painted and lettered case.

Stock No. 40-16215 **$52.50***

R+EW U.S. Agent

RADIOKIT

Box 411S, Greenville, NH 03048

(603) 878-1033 ↩69

*Shipping and Handling $2.50

UHF TO VHF CONVERTER

(dual purpose converter for 70cm to 2M and 70 cm to UHF TV band)

Specifications:

Freq. Coverage	8MHz in the band 430–440 MHz with 144–148 MHz IF.
RF Gain	8dB (single filter model)
Noise Figure	2.5dB (single filter model)

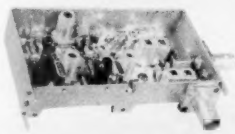
AMATEUR TELEVISION

Freq. Coverage	434–440 MHz
IF Frequency	726–732 MHz
RF Gain	5dB (single filter model)

GENERAL

Supply Voltage 10V stabilized
Supply Current 30 ma approx.

Complete kit of parts including PCB, components, xtals and enclosure



Stock No.	Input Freq MHz	IF Output (MHz) Commo	IF Output (MHz) ATV	Xtal Freq MHz
.....	432-438	144-148	722-728	96.0000 △
40-00170	434-436	144-146	724-730	96.6667
40-00270	436-438	144-146	726-732	97.3333 +
40-00370	436-440	144-148	728-734	98.0000 +

△ Supplied with all kits
+ Recommended for ATV

$60.50 each

SEMICONDUCTORS:				P.C. BOARDS FOR MOTOROLA BULLETINS	
MRF-208 - 12.00	MHW-252	- 50.00	EB-18A - 12.00	AN-762 - 14.00
MRF-240 - 15.50	MHW-710-1	- 61.00	EB-27A - 14.00	AN-791 - 10.00
MRF-247 - 34.80	MPSH-81	- .50	EB-63 - 14.00	EB-67 - 14.00
MRF-309 - 27.60	MV2205	- .58	KEMET CHIP CAPACITORS:56 pf, 82 pf,	
MRF-422 - 41.40	78L08CP	- .50	100 pf, 390 pf, 470 pf;-.50 ea	
MRF-454 - 20.00	2N4401	- .75	680 pf, 1000 pf;-.55 ea	
MRF-901 - 1.75	2N5190	- 1.50	5600 pf, 6800 pf, .1 µf;-1.00 ea	
SBL-1 Double-Balance Mixer - 6.50			.33 µf;-1.90 ea .68 µf;-3.90 ea	

CAMBION RF CHOKES: .15 µh, .22 µh, .33 µh, 4.7 µh, 10 µh - 1.20 ea
BROADBAND TRANSFORMERS PER MOTOROLA BULLETINS:AN-762, EB-27A, EB-63
UNDERWOOD/SEMCO METAL-CLAD MICA CAPACITORS:5pf,10pf,15pf,25pf,30pf, 40pf,56pf,60pf,68pf,80pf,91pf,100pf,200pf,250pf,390pf,470pf,1000pf

We also carry a line of VHF, UHF amplifiers and ATV equipment.
Call or write for our free catalog.

Communication Concepts Inc.

2648 North Aragon Ave•Dayton, Ohio 45420•(513) 296-1411 ↙14

NO MORE MISSED CALLS OR ANNOYING CHATTER.

INTRODUCTORY OFFER!
$89.
shipping & handling charges included

Speedcall's new DTMF commercial-grade kit lets you take control !

Now it's possible for individuals and repeater groups to have a personal (or emergency) commercial-quality DTMF system, at very low cost. Speedcall's new 312K decoder kit easily assembles into a compact, high-performance unit. Features include a virtually unfalsable "Wrong Digit Lockout" circuit which permits only correct signals to be accepted as valid. And the 312K decodes all sixteen digits, permitting expanded flexibility and special control applications.

Commercial versions of the 312K are used to perform selective calling of mobile fleet operations, on-off control of remote facilities (such as power, valves, pumps, etc.), and to receive the status of single functions (repeater site failure or intrusion, equipment vandalism, power failure, valve or compressor function change, etc.) Speedcall Corporation manufactures a complete line of DTMF signaling and control systems. For more information write or call Speedcall at 415/783-5611.

Kit with Enclosure, Reset Push Button and Buzzer ... $104.

Output: Single open collector output. 200mA.
Input Signal Range: 20mV to 6V (flat input).
Code Capacity: 3 to 8 digit address plus select any of the 16 touch-tone digits as desired.
Battery Voltage: 13.8VDC Nom. (9 to 16VDC) @ 30mA nominal on standby.
Assembled Dim: 3/4" H x 2-1/8" W x 3-3/4" L
With Enclosure: 1" H x 2-1/2" W x 4-5/8" L

To order, send check or money order to:

DEPARTMENT "K"
SPEEDCALL CORPORATION
2020 National Avenue • Hayward, California 94545
415-783-5611 ↙3

(California Residents add 6% Sales Tax)

HI-Q BALUN

- For dipoles, yagis, inverted vees & doublets
- Replaces center insulator
- Puts power in antenna
- Broadbanded 3-40 MHz
- Small, lightweight and weatherproof
- 1:1 Impedance ratio
- For full legal power and more
- Helps eliminate TVI
- With SO 239 connector

only $13.95

HI-Q ANTENNA CENTER INSULATOR

Small, rugged, lightweight, weatherproof
Replaces center insulator
Handles full legal power and more
With SO 239 connector

$6.95

HI-Q ANTENNA END INSULATORS

Rugged, lightweight, injection molded of top quality material, with high dielectric qualities and excellent weatherability. End insulators are constructed in a spiral unending fashion to permit winding of loading coils or partial winding for tuned traps.

May be used for:
- Guy wire strain insulators
- End or center insulators for antennas
- Construction of antenna loading coils or multiband traps

Patent No 4 091 350

$4.95

DIPOLES

MODEL	BANDS	LENGTH	PRICE WITH HI-Q BALUN	WITH HI-Q CENTER INSULATOR
Dipoles				
D-80	80,75	130	$31.95	$27.95
D-40	40,15	66	28.95	24.95
D-20	20	33	27.95	23.95
D-15	15	22	26.95	22.95
D-10	10	16	25.95	21.95
Shortened dipoles				
SD-80	80,75	90	35.95	31.95
SD-40	40	45	32.95	28.95
Parallel dipoles				
PD-8010	80,40,20,10,15	130	43.95	39.95
PD-4010	40,20,10,15	66	37.95	33.95
PD-8040	80,40,15	130	39.95	35.95
PD-4020	40,20,15	66	33.95	29.95
Dipole shorteners - only, same as included in SD models				
S-80	80,75		$11.95 pr	
S-40	40		$10.95 pr	

All antennas are complete with a HI-Q Balun or HI-Q Antenna Center insulator, No. 14 antenna wire, ceramic insulators, 100 nylon antenna support rope (SD models only 50) rated for full legal power. Antennas may be used as an inverted V and may also be used by MARS or SWLs.

Antenna accessories—available with antenna orders
Nylon guy rope 450# test 100 feet $4.49
Ceramic (Dogbone Type) antenna insulators $1.50 pr
SO-239 coax connectors .55

All prices are postpaid USA 48
Available at your favorite dealer or order direct from

Van Gorden Engineering Dealer Inquiries Invited

BOX 21305 B, SOUTH EUCLID, OHIO 44121

↙See List of Advertisers on page 114

FCC

In a flurry of activity, the FCC recently made several modifications in the amateur regulations. The change which has most likely affected amateur habits is the deletion of all logging requirements in Part 97. As of June 9, no transmissions had to be logged, unless specifically requested by the Commission. Third-party traffic is also exempt from any logging requirements.

The FCC also engaged in some housecleaning in an effort to clear up ambiguous regulations and delete outdated rules. Among those deletions was the requirement of a CW ID for amateurs using video and some common digital codes.

Finally, in an NPRM, the Commission proposed an expansion of the 10-meter repeater subband, citing the recent rapid growth in this area.

Here are the final orders and the NPRM as they appeared in the Federal Register:

Appendix

Parts 0 and 97 of Chapter I of Title 47 of the Code of Federal Regulations are amended as follows:

PART 0—COMMISSION ORGANIZATION

A.1. Section 0.314 is amended by adding new paragraph (x) as follows:

§ 0.314 Additional authority delegated.

* * * * *

(x) When deemed necessary by the Engineer-in-Charge of a Commission field facility to assure compliance with the Rules, a station licensee shall maintain a record of such operating and maintenance records as may be necessary to resolve conditions of interference or deficient technical operation.

PART 97—AMATEUR RADIO SERVICE

B.1. In § 97.79, paragraph (b) is revised to read as follows:

§ 97.79 Control operator requirements.

* * * * *

(b) Every amateur radio station, when in operation, shall have a control operator. The control operator shall be present at a control point of the station, except when the station is operated under automatic control. (Automatic control is only permitted where specifically authorized by the rules of this part.) The control operator may be the station licensee, if a licensed amateur radio operator, or may be another amateur radio operator with the required class of license and designated by the station licensee. The control operator shall also be responsible, together with the station licensee, for the proper operation of the station. (For purposes of enforcement of the rules of this part, the FCC will presume that the station licensee is, at all times, the control operator of the station, unless documentation exists to the contrary.)

* * * * *

2. In § 97.85, a new paragraph (g) is added to read as follows:

§ 97.85 Repeater operation.

* * * * *

(g) Each station in repeater operation transmitting with an effective radiated power greater than 100 watts on frequencies between 29.5 and 420 MHz, or 400 watts on frequencies between 420 and 1215 MHz, shall have the following information included in the station records during any period of operation:

(1) The location of the station transmitting antenna marked upon a topographic map having contour intervals and having a scale of 1:250,000 (indexes and ordering information for suitable maps are available from the U.S. Geological Survey, Washington, D.C. 20242, or from the Federal Center, Denver, CO 80255);

(2) The transmitting antenna height above average terrain (see Appendix 5);

(3) The effective radiated power in the horizontal plane for the main lobe of antenna pattern, calculated for the maximum transmitter output power which occurs during operation;

(4) The maximum output power which occurs during operations;

(5) The loss in the transmission line between the transmitter and the antenna (including devices such as duplexers, cavities or circulators), expressed in decibels; and

(6) The relative gain in the horizontal plane of the transmitting antenna.

3. In § 97.88, papragraph (a) is revised, and new paragraphs (f) and (g) are added to read as follows:

§ 97.88 Operation of a station by remote control.

* * * * *

(a) A photocopy of the license for the remotely controlled station shall be posted in a conspicuous place at the station location.

* * * * *

(f) The station records shall include during any period of operation:

(1) The names, addresses, and call signs of all persons authorized by the station licensee to be control operators; and

(2) A functional block diagram of the control link and a technical explanation sufficient to describe its operation.

(g) Each remotely controlled station shall be protected against unauthorized station operation, whether caused by activation of the control link, or otherwise.

4. Section 97.90 is added to read as follows:

§ 97.90 System network diagram required.

When a station has one or more associated stations, that is, stations in repeater or auxiliary operation, a system network diagram (see § 97.3[v]) shall be included in the station records during any period of operation.

5. Section 97.92 is added to read as follows:

§ 97.92 Record of operations.

When deemed necessary by the Engineer-in-Charge (EIC) of a Commission field facility to assure compliance with the rules of this part, a station licensee shall maintain a record of station operations containing such items of information as the FIC may require under Section 0.314(x).

§ 97.99 [Amended]

6. In § 97.99, paragraph (c) is removed.

§ 97.103 Undesignated heading. [Removed]

7. Section 97.103 and the undesignated heading "Logs" which precedes § 97.103 are removed in their entirety.

§ 97.105 [Removed]

8. Section 97.105 is removed.

§ 97.417 [Amended]

9. In § 97.417, papragraph (d) is removed.

PART 97—[AMENDED]

Part 97 of the Commission's Rules and Regulations, 47 CFR Part 97, is amended as follows:

1. In § 97.13, paragraphs (c) and (d) are revised to read as follows:

§ 97.13 Renewal or modification of operator license.

* * * * *

(c) Application for renewal and/or modification of an amateur operator license shall be submitted on FCC Form 610 and shall be accompanied by the applicant's license or a photocopy thereof. Application for renewal of unexpired licenses must be made during the license term and should be filed within 90 days, but not later than 30 days, prior to the end of the license term. In any case in which the licensee has, in accordance with the provisions of this chapter, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(d) If a license is allowed to expire, application for renewal may be made during a period of grace of five years after the expiration date. During this five-year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of its expiration. Application for renewal shall be submitted on FCC Form 610 and shall be accompanied by the applicant's license or a photocopy thereof.

§ 97.32 [Amended]

2. In § 97.32, paragraph (f) is removed in its entirety.

§ 97.61 [Amended]

3. In § 97.61, the parenthetical phrase in paragraph (e) is revised to read as follows:

* * * * *

(e) * * *

(when type F1 or A2] emissions are employed in these bands, the radio or audio frequency shift, as appropriate, shall not exceed 1000 Hz)

4. In § 97.69, paragraph (a)(3) is removed in its entirety and paragraphs (a)(2) and (b)(3) are revised to read as follows:

§ 97.69 Digital communications.

* * * * *

(a) * * *

(2) When type A2, F1 or F2 emissions are used on frequencies below 50 MHz, the radio or audio frequency shift (the difference between the frequency for the "mark" signal and that for the "space" signal), as appropriate, shall not exceed 1000 Hz. When these emissions are used on frequencies above 50 MHz, the frequency shift, in hertz, shall not exceed the sending speed, in baud, of the transmission, or 1000 Hz, whichever is greater.

(b) * * *

(3) The International Radio Consultative Committee (CCIR) Recommendations 476–2 and 476–3 (commonly known as AMTOR);

provided that the code, baud rate and emission timing shall conform to the specifications of CCIR 476–2 (1978) or CCIR 476–3 (1982), Mode A or Mode B.

* * * * *

5. Section 97.81 is revised to read as follows:

§ 97.81 Authorized apparatus.

(a) An amateur station license authorizes the use, under control of the licensee, of all transmitting apparatus at the fixed location specified in the station license which is operated on any frequency or frequencies allocated to the Amateur Radio Service, and, in addition, authorizes the use, under control of the licensee, of portable and mobile transmitting apparatus operated at other locations.

(b) The apparatus authorized for use by paragraph (a) of this section shall be available for inspection upon request by an authorized Commission representative.

6. In § 97.84, paragraph (g) is revised to read as follows:

§ 97.84 Station identification.

* * * * *

(g) The identification required by this section shall be given on each frequency being utilized for transmission and shall be made in one of the following manners:

(1) By telegraphy using the international Morse code (if this identification is made by an automatic device used only for identification, the code speed shall not exceed 20 words per minute);

(2) By telephony using the English language (the Commission encourages the use of a nationally or internationally recognized standard phonetic alphabet as an aid for correct telephone identification);

(3) By telegraphy using any code authorized by § 97.69(b), when the particular code is used for transmission of all or part of the communication or when the communication is transmitted in any digital code on frequencies above 50 MHz; or

(4) By video using readily legible characters when A5 emissions are used, the monochrome portions of which conform, at a minimum, to the monochrome transmission standards of § 73.682(a)(6) through § 73.682(a)(13), inclusive (with the exception of § 73.682(a)(9)(iii) and § 73.682(a)(9)(iv)).

* * * * *

7. In § 97.99, the introductory paragraph is revised to read as follows:

§ 97.99 Stations used only for radio control of remote model crafts and vehicles.

An amateur radio station in radio control operation with a mean output power not exceeding one watt may, when used for the control of a remote model craft or vehicle, be operated under the special provisions of this section, provided that a writing indicating the station call sign and the licensee's name and address is affixed to the transmitter.

* * * * *

8. In § 97.173, paragraph (d) is revised to read as follows:

§ 97.173 Application for RACES station license.

* * * * *

(d) If the application is for a RACES station to be in any special manner covered by § 97.42, those showings specified for non-RACES stations shall also be submitted.

PART 97—[AMENDED]

It is proposed that Part 97 of the Commission's Rules, 47 CFR Part 97, be amended as follows:

Section 97.61 paragraph (c) would be revised to read as follows:

§ 97.61 Authorized frequencies and emissions.

* * * * *

(c) All-amateur frequency bands above 29.0 MHz are available for repeater operation, except 50.0–52.0 MHz, 144.0–144.5 MHz, 145.5–146.0MHz, 220.0–220.5MHz, 431.0–433.0MHz, and 435.0–438.0MHz. Both the input (receiving) and output (Transmitting) frequencies of a station in repeater operation shall be frequencies available for repeater operation.

A DESIGN EVOLUTION

- Linear (all mode) RF power amp with automatic T/R switching (adjustable delay)
- Receive preamp option, featuring GaAs FETS (lowest noise figure, better IMD). Device NF typically .5 dB.
- Thermal shutdown protection incorporated
- Remote control available
- Rugged components and construction provide for superior product quality and performance
- Affordably priced offering the best performance per dollar
- Designed to ICAS ratings, meets FCC part 90 regulations
- 1 year transistors warranty
- Add $5 for shipping and handling (Cont. U.S.). Calif. residents add applicable sales tax.
- Specifications/price subject to change

MODEL 1	FREQUENCY 2	OUTPUT POWER	INPUT POWER	SUGG. PRICE LESS TAX
	(MHz)	(W)	(W)	$
1410 1410G	144	160	10	225 265
1412 1412G	144	160	30	199 239
2210 2210G	220	130	10	225 265
2212 2212G	220	130	30	199 239
4410 4410G	440	100	10	225 265
4412 4412G	440	100	30	199 239

1. Models with G suffix have GaAs FET preamps. Non-G suffix units have no preamp.
2. Covers full amateur band.

★SEND FOR FURTHER INFORMATION★

TE SYSTEMS

TE SYSTEMS ↩32
P.O. Box 25845
Los Angeles, CA 90025
(213) 478-0591

1982-1983
AMATEUR RADIO CALL DIRECTORY©

THE BARGAIN AT $14.95 Plus Shipping

A no frills directory of over 411,000 U.S. Radio Amateurs. 8½x11, easy to read format. Completely updated.

Also available for the first time ever—
(Alphabetically arranged—Sold separately)
Geographical Index
by State, City and Street No. and Call
Name Index
by Name and Call

Ordering Information:
- **Directory—$14.95**
- **Geographical Index—$25.00**
- **Name Index—$25.00**

Add $3.00 Shipping to all orders.

Dealers/Clubs inquiries welcome
Send your order—enclosing check or money order in U.S. dollars to:

Buckmaster Publishing
70-J Florida Hill Road
Ridgefield, CT 06877 U.S.A. ↩226

APPLIED INVENTION
THE SOURCE FOR SOLID STATE / STATE-OF-THE-ART

GaAs FETS by MITSUBISHI

NEW
2M – Ku Band. Very low noise and medium power. 1-4
MGF 1100 Dual Gate GaAs FET 2.5dBNF @ 4GHz $ 7.35
MGF 1202 (1402 chip in a 1200 package) $ 9.70
MGF1404 GUARANTEED 0.65dBNF @ 4GHz $66.60
MGF1402 · 0.4 dBNF @ 432, 1.1 dBNF @ 4GHz $14.00
MGF1412 GUARANTEED 0.8, 0.9 or 1.0 dBNF @ 4GHz $21.—$34.75
Also: MGF1200, MGF1400, MGF1403 and medium power MGF1801

MICROWAVE MODULES

MITSUBISHI X BAND Hybrid Integrated Circuits with Dielectric Resonator (0.12%Hz/°C) GaAs FET Oscillators

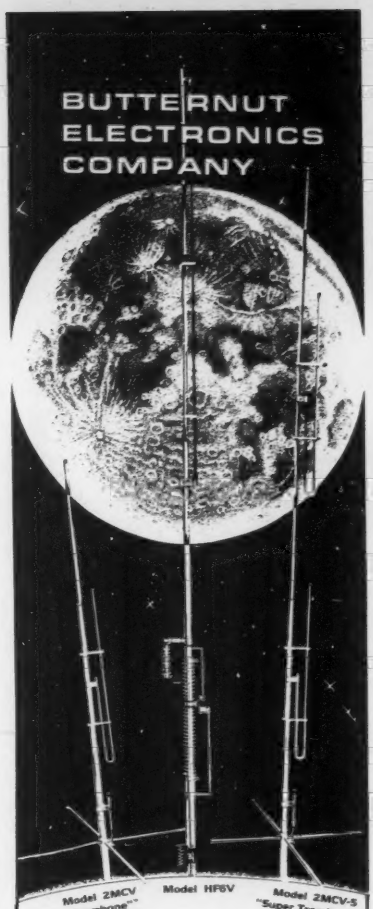
FO-1010X · 10.4 GHz, 15mw out, UER100 Flange	$39.37
FO-1210Y · 11.5 or 12.0 GHz, UER120 Flange	$39.37
* **FO-UP11KF** · Complete Heterodyne Rx, 10.468 GHz LO Use with 2 GHz IF for 12 GHz Satellite TV#0	$36.22
* **FO-DP13KF** Doppler Module 10.525 GHz UER100 Flange	$43.05
* **X-Band** 15 dBG die cast horn antenna (UER100)	$17.85
* **GaAs FET Preamp** 1.7-2.1 GHz, 2.0-2.35 GHz, 2dBNF	$49.00

COMPONENTS

	NEW
At THE SOURCE for RETICON Universal Active Filters	
R5620 digitally programmed switched capacitor filter	$ 7.85
R5621 dual resistor programmed SCF	$ 6.51
R5622 quad resistor programmed SCF	$11.07
Application notes	$ 2.00
OPTOELECTRONICS from MITSUBISHI and SIEMENS CW LASER DIODES, HIGH OUTPUT IRLEDS, PIN PHOTO DIODES, FIBER OPTICS, MORE!	CALL
MRF 901 Substitute 2SC2876, Ft=7GHz, 2.2dBNF @ 1GHz	$ 1.50
NEC 64535 direct replacement: Siemens BFQ 74	$ 9.66
LEADLESS DISK CAPS 100, 220, 470, 680, 1000 pF	10/ $ 2.50
MICROWAVE CHIP CAPS · Very low loss VITRAMON P7800 series G02(0.7-1.4 GHz) G04(1.3-2.6 GHz) G01(2.6-4.2GHz)	$ 1.25
VITRAMON VHF/UHF NPO chips: 10, 100, 1000 pF.	5/ $ 2.50
A-B type FW5N 1000pf Feedthru	$ 0.75
STRIPLINE SHUTTLE TRIMMERS (VOLTRONICS) 0.1-2.5, 0.5-9.0pF	$ 3.34
HI-Q SEALED CERAMIC PISTON TRIMMERS (VOLTRONICS) 0.6-9.0pF	$ 3.50
Thermo Electric Heat Pumps & Sub-Miniature Cryogenic Refrigerators CALL	
3M GX250 glass/fle board, Er=2.55 @ 10GHz 0.031	$0.31/sq. in.
0.062	$0.52 sq. in.
JOHNSON SMA's: Sq.flange female $3.50, Male cable $ 2.88	

PROMPT SERVICE. SEND FOR CATALOG MINIMUM ORDER $5.00
VISA/MASTERCARD Accepted. CASH prepay take 5% discount.
S&H * ITEMS (UPS) $3.75 - ALL OTHER ITEMS $2.50 (1st CLASS)
NY STATE RESIDENTS ADD 6% SALES TAX

R.D.2 ROUTE 21 HILLSDALE, NY 12529
518-325-3911 ↩71



THE Winners

Model HF6V...Completely automatic bandswitching 80 through 10 **plus** 30 meters. Outperforms **all** 4- and 5-band "trap" verticals of comparable size. Thousands in use worldwide since December '81! 160 meter option available now; retrofit kits for remaining WARC bands coming soon. Height: 26 ft/7.8 meters; guying not required in most installations.

Model 2MCV "Trombone"™ —omnidirectional collinear gain vertical for 2 meters having the same gain as "double-5/8λ" types, but the patented "trombone" phasing section allows the radiator to remain unbroken by insulators for maximum strength in high winds. No coils "plumber's delight" construction and adjustable gamma match for complete D.C. grounding and lowest possible SWR. Height: 9.8 ft/2.98 meters

NEW
Model 2MCV-S "Super-Trombone"™ —Same advanced features as the basic 2MCV but a full wavelength taller with additional "Trombone"™ phasing section for additional gain. Height: 15.75 ft/4.8 meters

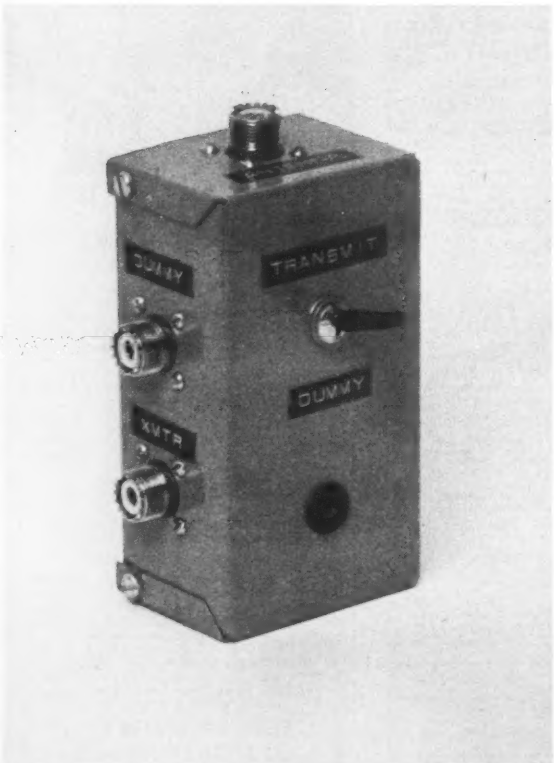
All BUTTERNUT ANTENNAS use stainless steel hardware and are guaranteed for a full year. For further information on these and other BUTTERNUT products write for our FREE CATALOG!

BUTTERNUT ELECTRONICS
405 E. Market St. Lockhart, TX 78644

↩See List of Advertisers on page 114

Build This Super Switch

The only thing this switch won't do is brew your coffee. It's the lazy man's delight.



The lazy man's switch box.

R. K. Forsyth K4YS
1012 West Street
Rockledge FL 32955

Although I've often heard that necessity is the mother of invention, I believe that in my case it was just pure laziness. And that is why I designed and built the switch box to be described. It does all of the following things with just one flip of a switch:

- Connects your transmitter to your dummy load for initial tune-up.
- Connects your transmitter through your antenna-matching unit to your antenna for final tune-up and transmit.
- Disconnects the center lead of your antenna coax from your equipment and grounds it to your coax shielding when you are finished transmitting.
- Provides a simple, visual rf power-output monitor from your transmitter.

The switch box did not just develop at one time but came about as the result of an analysis of problems common to most amateurs.

Although many amateurs have dummy loads, often they are not used because disconnecting your coax cables from your tuning unit and connecting your dummy load for an initial tune-up takes time and is inconvenient. But there are some real advantages in first tuning up into your dummy load that should be considered in more detail.

First, you eliminate unnecessary QRM, which is important in our already overcrowded bands. And there is another technical advantage. By tuning up your transmitter into your dummy load initially, you are assured that your swr is 1:1, which prevents the possibility of excessive rf currents or voltages damaging your equipment. After you are properly tuned up into your dummy load, you should

not do any further adjusting of your transmitter rf controls. Then when you switch over into your antenna system, you have only to adjust your antenna-matching network. And by either remembering approximately where the dial settings of your tuning unit are for the various frequencies or using a simple chart or graph to set the dials, you can again keep your swr down to a reasonably low level until you fine-tune the controls for an swr of 1:1.

This technique, which actually is only good engineering practice, reduces your tune-up time and protects your rig as much as possible from dangerous tune-up conditions. Attempting to tune up your equipment without first going through the dummy load step just outlined means that you are trying to adjust both your transmitter and tuning-unit dials at the same time. This can lead to dangerous impedance mismatch conditions until your swr reaches its final lowest value. This haphazard procedure is not to be recommended if you value your equipment.

The provision of disconnecting the center lead of your antenna coax from your equipment and grounding it to the coax shield when your station is shut down is a common-sense precaution that will drain off any static voltage buildup and eliminate any effects of induced voltages from a nearby lightning strike. In my own case, I had a diode in my swr meter burn out a couple of years ago when my antenna was not grounded and lightning hit nearby. That one experience made a believer out of me, and now I never leave my shack without first making sure that my equipment is disconnected from the antenna circuit.

It should definitely be pointed out, however, that just disconnecting the center of your antenna coax and grounding it to the shield is not a lightning-protection device! When lightning hits your antenna system directly, it can easily travel down the shield and, because of the extremely high voltages and currents involved, cause all sorts of damage. In a heavy lightning storm it is best to completely disconnect all incoming antenna leads to your shack and ground your antenna outside directly through a really heavy cable to a good ground. At least that is the procedure I've been using here, particularly since Florida has more lightning storms than any other state in the Union.

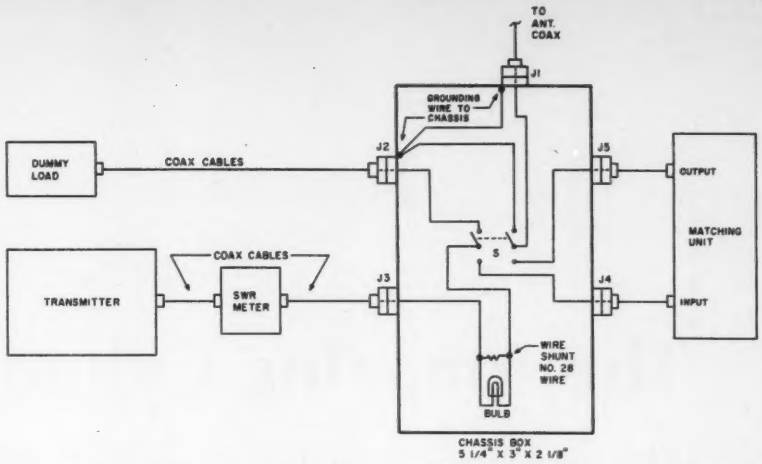


Fig. 1. Schematic diagram. J1-J5—SO-239 coax jack. S—275-652, 6-A DPDT switch. Bulb—PR2, 2.38 V, 500 mA. Mounting hardware—20 #4-40 ½-inch round-head machine screws and nuts. Grommet—bag of assorted sizes. All parts from Radio Shack.

The rf-monitor circuit is nothing more than a simple small incandescent bulb shunted down with about three inches of number 28 wire in series with the rf output of the transmitter. The size of the bulb and the shunting wires are dependent, naturally, upon the power you run. In my case, a PR2 lamp from Radio Shack rated at 2.38 volts, 500 mA, worked just fine with my Ten-Tec Omni D. The friendly blinking light makes it fun to operate in a partly darkened room, as I often do in the evenings. And it is always reassuring to have a continuous monitor to tell you that everything is working as it should. As shown in the photograph, the bulb is just pushed into a rubber grommet, which makes for a good, neat, and insulated mounting.

Actually, the basic idea is as old as ham radio and makes me remember many years ago when a single turn of the wire soldered to a flashlight bulb was one of my most valuable tools. It was useful in neutralizing, tuning up the transmitter, and checking output when placed near the antenna coupler.

As seen in the diagram, the circuit is simple and the wiring is straightforward. The layout is not critical, and the project is simple enough to be, perhaps, an amateur's first attempt in getting acquainted with the fun of building his own gear.

After all the holes were drilled, a coat of gray enamel was used to paint the outside of the box. It was dried overnight and then baked in the oven at 250° F for fifteen minutes to provide a hard, good-looking finish. The decals added the final touch and ensured that I got my cables hooked properly.

Because the chassis box is of split construction, a wire was connected from J1 to J2 inside of the box so as not to have to rely upon the chassis contact for an rf path. Although a six-Ampere switch was used, I did try the unit at a friend's station with a linear amplifier, and the unit worked fine without the switch heating or any arc-over. However, ten-Ampere switches are commercially available for amateurs who may be running a California kilowatt. All other parts were obtained from Radio Shack, which simplified procurement problems.

Tests showed that, as expected, insertion of the unit changed the original settings of the antenna-matching unit slightly. (This generally happens whenever you change the configuration of your coax cables, probably because of such things as induced currents in coax shields or other minor secondary effects.) As in all rf projects, keep all cables and connections as short as practical and be sure that your coax jacks are well grounded to the chassis.

The real value to me has been the ease with which I can now tune up first into my dummy load and then, with a flip of the switch, into my tuning unit and antenna. It sure is a lazy man's switch box! ■

John M. Franke WA4WDL
1310 Bolling Avenue
Norfolk VA 23508

The Amazing Cylindrabola

This microwave antenna is easier to build than a dish. But it works just as well.

When you mention microwave antennas to most amateurs, the image that comes to mind is a large circular dish antenna. I have nothing against this type of antenna and use it at work and at home. However, I feel that many amateurs are turned away from microwave frequencies when they see the constructional difficulty of building a three-dimensional parabolic surface.

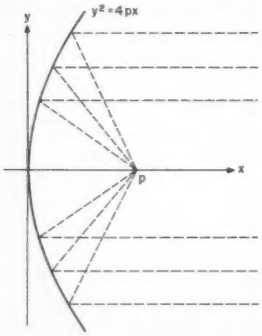


Fig. 1. Parabolic curve.

When maximum gain is needed, the full parabola is necessary, but there are times when it is not. After all, most amateurs just starting out on the high frequency bands do not initially erect rhombics. In recent months, I have been asked to build antennas for monitoring a studio microwave link for a local television station and for intercepting synchronization pulses from a radar site. In each case, the requirements were for moderate beamwidth, medium gain, and low cost. The last requirement was the primary goal. Each request was solved with the same antenna—a cylindrical parabola.

The cylindrical parabola is easily fabricated by hand with sheet metal formed in only one plane. The prototype unit described here was tested initially with an MDS receiver. The MDS signal offers several benefits to antenna work. First, the wavelength (14 cm) is short enough to permit reasonable-size antenna dimensions. Second, the signal is far enough away (3 miles from my location) to approximate a far field source. Third, the signal is available 24 hours a day—they maintain it, not I. And fourth, the bandwidth is large—6 MHz.

The major shortcoming of a cylindrical parabola is the unequal E- and H-plane beamwidths. The beamwidth is smallest in the plane of the curve. The smaller beamwidth is the same as for a dish antenna of the same diameter, while the larger beamwidth is essentially the beamwidth of the feed.

The antenna consists of two parts: the reflector and the feed. Both of the tasks referred to above were handled with the same reflector but with a difference in the size and type of feed. The studio-link

y	x
0	0
± 1"	0.05"
± 2"	0.20"
± 3"	0.45"
± 4"	0.80"
± 5"	1.25"
± 6"	1.80"
± 7"	2.45"
± 8"	3.20"
± 9"	4.05"
± 10"	5.00"
± 11"	6.05"

Table 1. X and y values used to make 22-inch-wide, 5-inch focal length cylindrical parabola antenna.

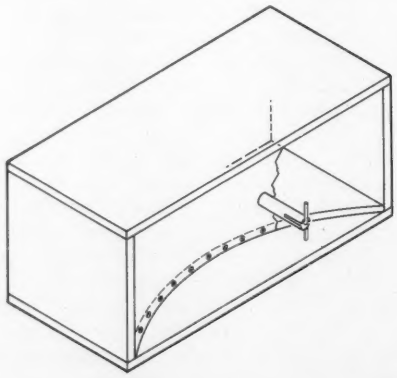


Fig. 2. Box construction with cutaway view of the lower surface support rib.

monitor used a slotted dipole like the one to be described. The radar monitor used a waveguide-to-coax transition as a feed.

The equation for the shape of a cylindrical parabola is identical to that for a circular parabola: $y^2 = 4px$, where y = distance measured tangent to the vertex, x = distance measured perpendicular to the vertex, and p = focal length of the antenna.

Fig. 1 is a graph of a parabola. The table gives the x and y coordinates of the curve used for the antenna shown in the photo. It has a focal length of five inches and a width of 22 inches. The height of the surface is one foot—just over two wavelengths. Increasing the height has little effect on the gain due to the rapid falloff of the radiation pattern of the dipole feed. The same effect is noted with corner reflector antennas.

A thin aluminum sheet was used for the reflector surface because I had some aluminum flashing left over from a home-improvement job. Hardware cloth or coarse wire screen could also have been used; as long as the largest opening is less than one-tenth wavelength, no degradation will be noticed. The aluminum sheet was fastened to the ribs with number 7 sheet-metal screws spaced 2 inches apart. (If wire screen were used, it could be stapled in place.)

The metal sheet was spray-painted flat white before final installation. The paint improves the antenna appearance but more importantly it serves as a fire preventative. The natural aluminum surface forms a good reflector for visible and infrared solar radiation. The intensity at the focus is sufficient to ignite a small stick in seconds.

The parabolic shape is maintained by two ribs made from half-inch plywood. The curve was laid out on graph paper, plotting the curve for y=0 to y=11. The curve was transferred to the plywood by tracing over the curve with carbon paper placed between the graph paper and the plywood. The graph then was flipped over and the other portion of the curve traced out. The two ribs were clamped together and cut simultaneously on a bandsaw. (No, I do not have a bandsaw. I use one at the Naval Air Station hobby shop, a benefit of being a weekend warrior.) The overall construction is shown in Fig. 2 and in the photograph.

The slotted dipole feed is similar in design to the one described in my article on a short backfire antenna published in the October, 1982, issue of *73*.

I do not have facilities for determining antenna gain directly, but I can make gain comparisons by placing an attenuator between the MDS converter and the receiver and noting how much attenuation must be added or subtracted to maintain a constant signal level when different antennas are connected. The completed antenna displays a gain of 10 to 11 dB over the popular coffee-can horn antenna. By simple aperture ratioing, the expected gain is 11 dB; the full height is not illuminated, however, so the 10-11-dB measurement is reasonable. ■

OUR ISOLATORS FOR YOUR PROTECTION

Prevents:
disk drive woes, printer interaction, memory loss and damage due to lightning or AC power line disturbances.

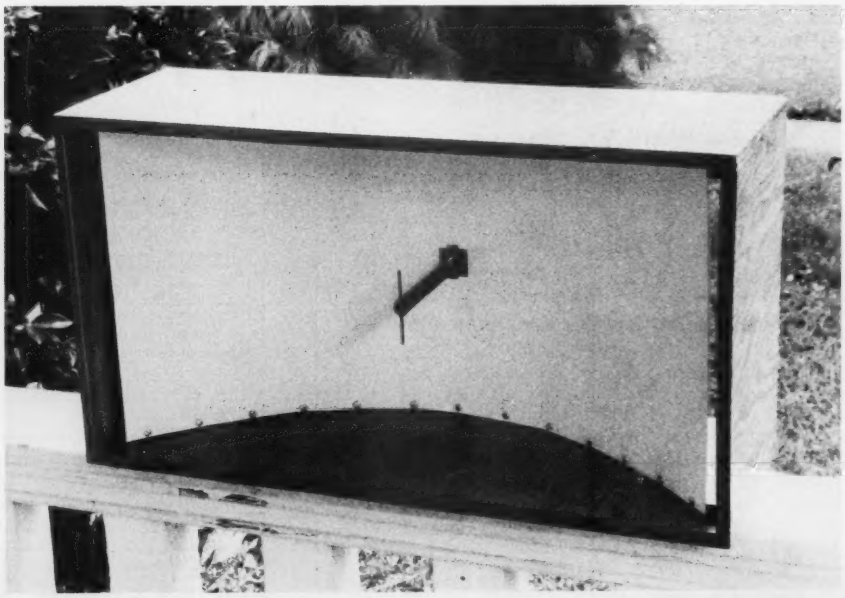
Commercial Grade Isolators
ISO-1 3 Isolated Sockets $76.95
ISO-2 2 Isolated Socket Banks, 6 Sockets 76.95

Industrial Grade Isolators
ISO-3 3 Double Isolated Sockets 115.95
ISO-11 2 Double Isolated Banks, 6 Sockets 115.95

Laboratory Grade Isolators
ISO-17 4 Quad Isolated Sockets 200.95
ISO-18 2 Quad Isolated Banks, 6 Sockets 169.95

Circuit Breaker, any model (Add-CB) Add 10.00
Remote Switch, any model (Add-RS) Add 18.00

ESP Electronic Specialists, Inc.
171 South Main Street, Box 389, Natick, Massachusetts 01760
Toll Free Order Desk 1-800-225-4876
MasterCard, VISA, American Express
18



The finished antenna.

See List of Advertisers on page 114

Introducing The SRT-3000 A High Performance RTTY Communications Send-Receive Terminal

SRT-3000
List Price $ 995.00
INTRODUCTORY PRICE $ 795.00

• Built-in demodulator & AFSK modulator for 170,425,850 Hz shifts, high and low tone pairs • 60,66,75,100,132 WPM Baudot, 110,300 Baud ASCII, 5-99 WPM Morse • 1000 character text buffer with BREAK feature • Ten 80 character message memories with battery backup • Selectable display formats, 24 lines x 72 characters (2 pages), 24 lines x 36 characters (4 pages), 16 lines x 36 characters (6 pages) • Split screen operation • On screen status line displays a tuning bar, mode, speed, shift, tone pair, normal/reverse, USOS, WRU, SELCAL, buffer mode and buffer count • Cassette interface for long "Brag Tapes" or unattended message storage • Baudot and ASCII printer outputs • Built-in audio monitor • Built-in 110 VAC power supply • Other features—PTT control, WRU, SELCAL, sync idle, CW ID, USOS, autostart, full or half duplex, scope outputs, weight control, intercharacter spacing, reverse video, RS-232, word wrap around • Compact size only 13.3 x 10.3 x 4 inches • Made in USA.

Send For Free Information

DGM ELECTRONICS, INC.

Optional 9" video monitor as shown $149.00

787 BRIAR LANE, BELOIT, WISCONSIN 53511 (608) 362-0410

YOU'LL NEVER GET A BETTER DEAL

HUSTLER ANTENNAS

SF2 - "Buck Buster" 5/8" Wave 2 Meter Antenna w/3/8 x 24" Threaded Base - 3dB gain **$8.95**

HOT - EASY ON/OFF TRUNK MOUNT with 3/8 x 24" Swivel Ball for CG144 & SF-2 **$14.95**

CG144 5.2dB gain Collinear w/3/8 x 24" Threaded Base **$23.95**

G6144 - 6dB Base Antenna **$68.50**

G7144 - 7dB Commercial Grade Base Antenna **$98.00**

And many other Hustler Antennas & Mounts

BBL144	25.95	MRK-1	13.75
BBLT144	35.00	SFM	24.25
BBLT440	24.75	THF	13.95
HLM	13.95	UHT-1	8.95

CECO STOCKS THE ENTIRE HUSTLER VHF/UHF & COMMERCIAL LINE

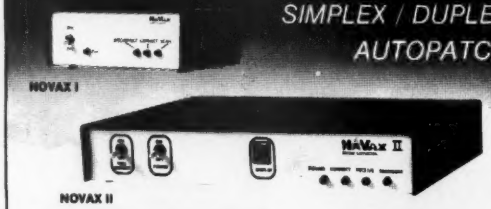
DEALER INQUIRIES INVITED

CeCo COMMUNICATIONS, INC. ↩7

2115 AVENUE X
BROOKLYN, N.Y. 11235
(212) 646-6300
(800) 221-0860
TELEX: 235125

Introducing our Latest Model — NOVAX II

SIMPLEX / DUPLEX AUTOPATCH



NOVAX I

NOVAX II

NOW TWO MODELS TO SERVE YOU BETTER

YOUR OWN PRIVATE AUTOPATCH

NOVAX
MOBILE CONNECTION

NOVAX interfaces your standard 2 meter; 220; 450; etc. Base station and telephone, using a high speed scan switching technique so that you can direct dial from your automobile or with your HT from the backyard or poolside — Automatically ... Easy installation transceivers, featuring solid state switching, offer best results ... Available interfaced with an ICOM 22U.

FEATURES	NOVAX I	NOVAX II
• 3 min. Call duration timer	YES	YES
• Up to 45 sec. activity timer	YES	YES
• Single digit Access Control	YES	NO
• DTMF (Touch Tone)* phone connection	YES	YES
• 4 digit Access Control	NO	YES
• Toll Restrict	NO	YES
• LED Digital Display	NO	YES
• Vinyl covered alum. case size	5" x 6" x 2"	10" x 8" x 1¾"
• Directly Interfaces with Repeater	NO	YES
• Rotary Dial System (incl. Last digit dial)	NO	YES—"Option"
• Ring Back (reverse autopatch) "Option"	YES Kit	YES—Wired

* Trademark ITT

↩21 To order, send check, money order to: MASTER CHARGE AND VISA ACCEPTED

CURRENT DEVELOPMENT CORPORATION
Box 162 - Tudman Rd.
Westmoreland, N.Y. 13490
or Phone 315-829-2785

The Spider™ Maritimer™ Antenna

U.S. PAT. 4349825

The only multi-band amateur radio antenna designed specifically for use on ocean-going boats and in areas close to the ocean.

- Non-magnetic stainless steel mast with nickel-chrome plated fittings give the best protection against salt water corrosion.
- No switches of any kind—no moving contacts to corrode, ever!
- Four amateur bands without changing coils—10, 15, 20 and 40 meters. **PLUS**, add the Spider™ Adapter collar and special resonators for commercial marine frequencies and you have **SEVEN** bands at your command at all times without any switching or changing coils.
- Less than six feet high so it can be stern-mounted on the transom for an easy installation.
- Approximately 50 ohm base impedance—requires no antenna tuner in the transmission line.
- SWR is approximately 1:1 at all selected resonant frequencies.
- Each resonator is tuned to the desired portion of the band by a tuning sleeve which slides over the outside of the resonator.
- ***Accessories for Marine Use*** —Stainless steel and corrosion-resistant ball mounts, angle mounting brackets, stud mounts and quick disconnects. RG58C/U coaxial cable with non-contaminating jacket. Coaxial fittings. Copper foil ground strapping.
- *A note or phone call will get you full information and prices—include phone number.*

MULTI-BAND ANTENNAS
7131 OWENSMOUTH AVENUE, SUITE 463C
CANOGA PARK, CALIF. 91303
TELEPHONE: (213) 341-5460 ↙173

RTTY

NEW

TU-470
- Full featured RTTY to 300 baud plus CW terminal unit.
- 3 Shifts, active filters, remote control, xtal AFSK, FSK, plus much more.

Suggested retail price..$499.95

TU-170A
- Single shift RTTY terminal unit.
- Xtal AFSK, FSK, active-filters and more.

Kit **$189.95**
wired $289.95

TU-170
- Single shift RTTY terminal unit.
- Low cost, AFSK, active-filters.

$149.95
(Kit only)

TRS-80* RTTY/CW
ROM-116 Interface for model I, III, IV (16K MIN). All standard Baudot & ASCII rates to 1200 baud. Text editing, auto CW/ID, split screen, RTTY art, & much more. Proven reliable & available on tape or disk. Disk MAILBOX software available too. Call or write for more details & special prices.

*Trademark of TANDY CORP.

SALES ONLY
1-800-HAM-RTTY
Flesher Corporation
P.O. BOX 976
↙23 TOPEKA, KS. 66601

If you need QUARTZ CRYSTALS

—one or hundreds—

YOU NEED JAN

- high stability
- prompt service
- cost savings

- General Communication
- Industry
- Marine VHF
- Scanners
- Amateur Bands
- CB Standard
- CB Special
- Microprocessor

↙39

Call or Write
JAN CRYSTALS
P.O. Box 06017
Ft. Myers, Fl. 33906-6017
All Phones (813) 936-2397

"BEEPER III"

"THE PROFESSIONAL TOUCH COMES TO AMATEUR RADIO!"

"BP-3 automatically provides a gentle high frequency beep at the beginning of each transmission and a low beep at the end. Virtually eliminates "talk-over"! Operates for up to one year on a single 9-V battery (not supplied). Can be directly interfaced to any transceiver which is keyed by grounding the PTT line (the PTT line voltage must be positive, not greater than 24 VDC, nor the current greater than 100 ma.) Works with virtually all modern gear. You've heard it; now you can have it!"

"ADD THE BEEP!"

"BP-3A Complete with case, cable, Standard 4-pin connectors	$9.95 pp
BP-3B As above except without connectors. Add your own	$6.95 pp
BP-3C Circuit-board version for custom installation	$9.95 pp

All units assembled/tested. OH residents add 6% Sales Tax"

FAXSCAN INC. ↙85
3148 Dorf Drive • Dayton, Ohio 45418 ™

↙See List of Advertisers on page 114

Colorful RTTY: An Advanced System for the TRS-80C

It's all here—a TU, program, and modem to turn your CoCo into a professional-quality RTTY terminal.

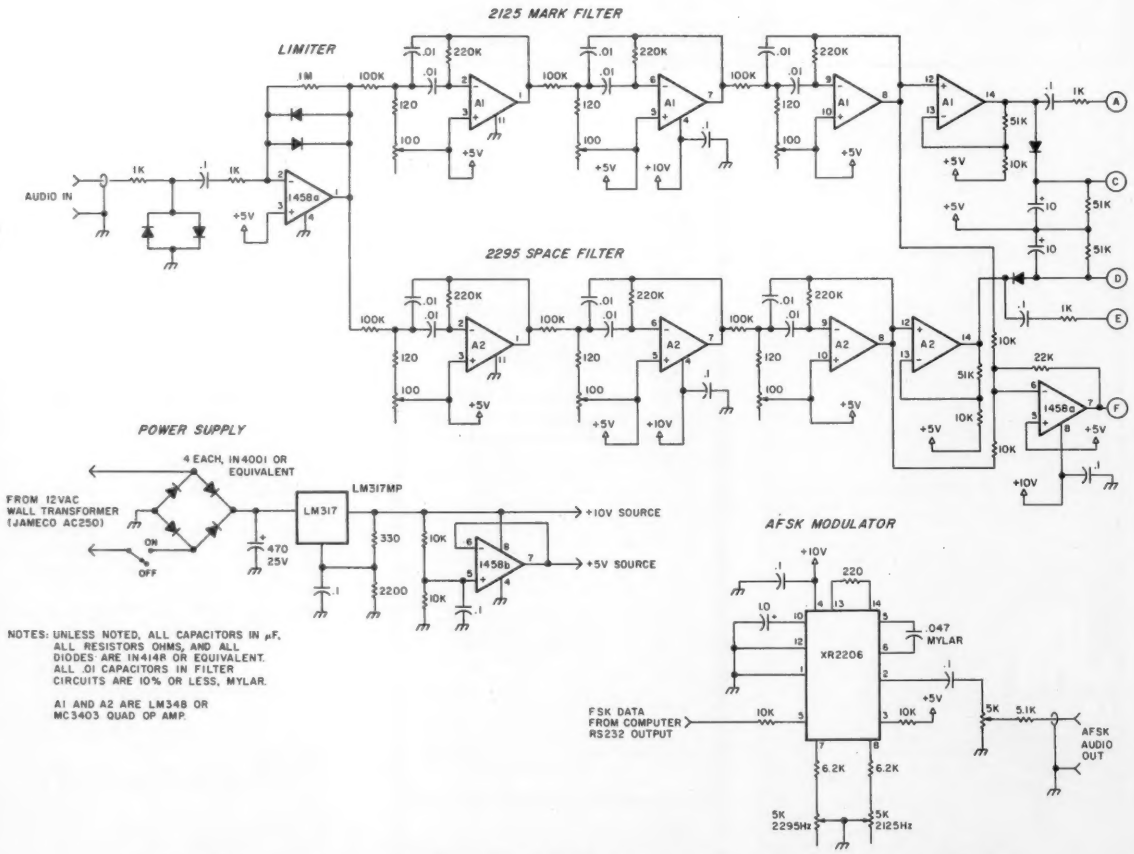


Fig 1(a). Filters, power supply, and modulator for the 170-Hz shift RTTY modulator/demodulator.

Clay Abrams K6AEP
1758 Comstock Lane
San Jose CA 95124

One of the most powerful low-cost computers available to date is the Radio Shack TRS-80C Color Computer, affectionately called the CoCo. The CoCo computer has grown in popularity over the past few years due to its low price and ease of expansion. It's hard to imagine how such a powerful computer can be sold at such a low cost.

Cost, however, is not the major attribute of this little computer. Tandy made a wise choice in selecting the 6809 processor for use in the CoCo. This processor is one of the least understood microcomputers available to date. It has many features which do not exist in any other microcomputer. Since my topic here is really amateur radio teletype, I'll show how this processor stands in a class by itself later in this article.

I would like to reach a couple of objectives in this article: to provide a small RTTY program which can be used as is or modified to add any features desirable, and to discuss a simple RTTY interface which can be purchased or constructed to get you on the air at minimal cost. But first, a little background on how this program was written.

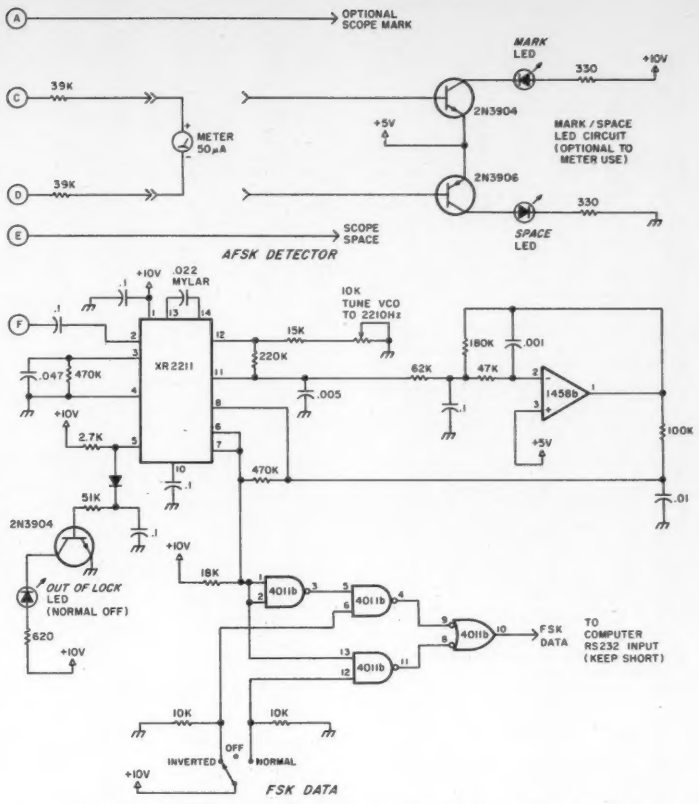


Fig. 1(b). Detector and tuning outputs for RTTY modulator/demodulator.

Program Background

Back in 1976, I wrote my first crude RTTY program for the South West Technical Products 6800 system. Do a few of you old-timers remember this computer? One can be seen from time to time even in flea markets. It became obvious in those early days that computers were the way of the future. The only big challenge to manufacturers was to drop their prices to a reasonable level.

After a few years of experimentation and further developments, I succeeded in writing a total of six RTTY programs for the 6800. In this period, I learned a lot and made a lot of mistakes. In 1980, I upgraded to the 6809 processor, which was a big step. But after a few months it became obvious that this processor was designed to be friendly and easy to program—unlike the 8080, 8088, Z80, 9900, and the 6502.

Probably the biggest moment in the history of the 6809 was Tandy's announcement of the CoCo in late 1980. As you might have guessed, I had one of these computers a few weeks after the announcement. In those days, a 4K computer was the norm, and one of my first challenges after developing some SSTV software was to write a RTTY program which would run on a 4K CoCo. I was very surprised to find that the CoCo was ideal for amateur radio applications. It was free from RFI susceptibility, even with 1 kW, and no birdies could be found on the HF receiver on any band. After the horror stories I heard about the TRS-80 Model I and other popular, expensive, well-known computers, I was very happy.

In this article you will see the results of my early RTTY efforts. Since this time, other RTTY programs have been written with greater features, but the basic principles are the same.

One point which must be emphasized is that if you desire to write programs for real-time high-speed applications, you should use machine language. A few RTTY programs have been written in Basic, but you can never achieve satisfactory results with it. Basic interpreters are too slow. The use of FORTH or the C language should work almost as well as machine language.

When designing a RTTY application program, a few fundamental decisions must be made even before starting to flowchart the code. These decisions are related to the hardware you use. In hardware selection, you have two possibilities. The first is to design the hardware to perform all the serial-to-parallel RTTY conversions. This requires the use of relatively complex hardware and relatively easy-to-write software. The advantage of this technique is for the manufacturer. The hardware costs can be passed along to the consumer and the manufacturer will not have to spend as much time writing software. This type of system has other advan-

Fig 2. Program listing.

```
SYMBOL TABLE:

ASCH    FFFE  ASCII   0AF9  ASCII1  0AFB  ASCII2  0B01  ASCII3  0B10
ASCII5  0B19  ASCII6  0B1D  ASCIO   0AC0  ASCIO1  0ACC  ASCIO2  0AD0
ASDEL   0AEF  ASDEL1  0AF3  BAUD    FFFD  BAUDA   0C4E  BAUDR   0642
BRATD   0C4C  BRATR1  0C4B  BRATR2  0C4A  BS      066F  BS1     0673
BUF     0C50  BUF0    0C60  BUF1    0D5F  BUF2    0E5E  CDEL1   0B5D
CDL1    0B66  CDL2    0B6B  CODE    FFFF  COPYR   0746  CR      0084
CURS    0677  CURS1   067D  CURS2   0683  CW      0B46  CW1     0B4A
CW2     0B4F  CWDEL   0640  CWL     0B9D  CWL1    0BAC  CWL2    0BD7
CWL3    0BE8  CWL4    0BCC  CWL5    0BEC  CWL6    0BE5  DASH    0B77
DEL     0937  DEL2    0930  DEL2C   0634  DEL3    093D  DEL3C   0636
DEL4    0946  DEL4C   0638  DEL5C   063A  DEL6C   063C  DEL7C   063E
DELA1   0B5B  DELA2   0B63  DOT     0BBB  END1    0B54  FIF2    09B7
FIF3    09D6  FIF4    09EF  FIF5    09CF  FIF6    09F4  FIF0    09AF
FIFO1   0956  FIFO5   097D  FIFO6   0979  FIFO7   0988  FIFO8   0995
FINDA   082A  FINDA1  0839  FINDA2  0842  FINDA3  0854  FINDA4  0841
FINDB   07DC  FXMT    09A6  IN      0644  IN100   06D7  IN60    06B9
IN60A   06C3  IN60B   06BD  INE     0650  INEEE   064C  LAST    FFFC
LET     0814  LF      0808  LOU     FFFB  LOU1    0762  LOW     0846
MAINC   0B31  MAINC1  0B35  MAINC2  0B57  MARK    0889  MASK    FFF9
MENU    06DD  MENU1   06C9  MENU2   0A0F  MENU3   0C17  MENU4   0715
MENU5   0731  MENU6   0A53  MONIT   0613  NEXT    0631  OUT     0664
OUT1    066E  OUTEEE  065C  PIA     FF20  PIA2    FF22  QUE     080C
RECT1   08E9  RECT2   08FB  RECT3   090C  RECT4   0920  RECT5   092D
RECTB   090D  RECTB1  091C  RECTB2  0914  RECTB3  091B  RECV    08B7
RESTAR  A027  RETA    0824  RETA1   0820  RETA2   081E  RSIN    A000
RSOUT   A002  SP      0810  SPACE   087D  SPACE1  0B70  SPEED   0689
SPEED1  069E  SPEED2  06A3  SPEED3  06B4  START   0600  STATB   0A68
STATB1  0ABE  STATB2  0AA9  STATB3  0AB1  STATB4  0AB0  STATB5  0ABC
STATB6  0ABA  STATB7  0ABA  TABCH   0BF3  TABNUM  0C0D  TR2     0864
TR3     086B  TR4     086D  TR5     0874  TRTTC   09FA  TRTTC1  0A04
TRTTY   085B  TRTTY1  0861  UD      FFFA  UD1     079D  UL      0895
UL1     089D  UL2     0BAF  UL3     0BAA  UL4     0BAC  UP      084C
```

```
                        *
                        * RTTY Program for the Radio Shack TRS-80C
                        * Color Computer (4K or larger sized computer)
                        *
                        * ************************************************************
                        *               Clayton W. Abrams (K6AEP)
                        *                  1758 Comstock Lane
                        *                  San Jose, Calif.
                        *                     95124
                        ************************************************************
                        *  COPYWRITE NOTICE
                        *  Use of this program is authorized for amateur radio
                        *  non profit purposes. The program source may be modified,
                        *  reproduced as long as credit for the original work is
                        *  given to this author.
                        ************************************************************
                        *             (C) Clayton W. Abrams, 1981
                        *
                              OPT PAG
                        *
0600                          ORG $0600
                        *
                        * Program Equates
                        *
              FF20      PIA     EQU $FF20       RS 232 Port (OUTPUT) in TRS-80C
              FF22      PIA2    EQU $FF22       RS 232 Port (INPUT) in TRS-80C
                        *
              A000      RSIN    EQU $A000       TRS-80C input a character vector
              A002      RSOUT   EQU $A002       TRS-80C output a character vector
              A027      RESTAR EQU $A027        Basic restart vector
                        *
                        * Program variables for temporary storage
                        * All references are made relative to the
                        * the user stack.
                        *
              FFFF      CODE    EQU -1          Baudot coded char to be translated
              FFFE      ASCH    EQU -2          ASCII coded char to be translated
              FFFD      BAUD    EQU -3          Translated Baudot Code
              FFFC      LAST    EQU -4          Last BAUDOT shift
              FFFB      LOU     EQU -5          Current BAUDOT shift
              FFFA      UD      EQU -6          Current shift code to be xmitted
              FFF9      MASK    EQU -7          Program in ASCII or BAUDOT, @=BAUDOT
                        *
                        * Initalization message for the program
                        *
0600 1F   4I  0602 32   START   TFR S,U         Find current system stack
0602 32   E8 EC               LEAS -20,S      Place system stack below user stack
0605 6F   59                  CLR MASK,U      Set up for BAUDOT
0607 17   00AF                LBSR IN60       Initalize for 60 WPM
060A 30   8D 0138             LEAX COPYR,PCR Display COPYWRITE NOTICE
060E 8D   54                  BSR OUT         Output it to screen
0610 17   058A                LBSR CWL        Ask for CW ID message
                        *
                        * Normal main line return when program
                        * is executing
                        *
```

```
0613 30   8D 00C6  MONIT  LEAX MENU,PCR Display main line monitor
0617 8D   4B              BSR OUT       Output it
0619 8D   31              BSR INEEE     Get an input character
061B B1   0C              CMPA #$0C     If CLEAR key return to BASIC
061D 27   12              BEQ NEXT
061F B1   52              CMPA #'R      Receive RTTY
0621 1027 0292            LBEQ RECV
0625 B1   58              CMPA #'X      Xmit RTTY
0627 1027 0324            LBEQ FIFO
062B B1   53              CMPA #'S      Select speed
062D 27   5A              BEQ SPEED
062F 20   E2              BRA MONIT     Look for another key
                        *
                        * Go back to basic
                        *
0631 7E   A027    NEXT    JMP RESTAR    TRS80C BASIC restart
                        *
                        * Program delay constants
                        *
                        * 60 WPM BAUDOT
                        *
0634 0A20               DEL2C  FDB $0A20      Data bit delay
0636 0E00               DEL3C  FDB $0E00      Stop bit delay
0638 0500               DEL4C  FDB $0500      1/2 data bit delay
                        *
                        * 100 WPM BAUDOT
                        *
063A 0633               DEL5C  FDB $0633      Data bit delay
063C 0BD3               DEL6C  FDB $0BD3      Stop bit delay
063E 031A               DEL7C  FDB $031A      1/2 data bit delay
                        *
                        * CW DEL CONSTANT
                        *
0640 1600               CWDEL  FDB $1600      Approximately 15 WPM
                        *
                        * ASCII 110 BAUD DELAY
                        *
0642 047F               BAUDR  FDB $047F      Data bit delay
                        *
                        * I/O ROUTINES THROUGH
                        * TRS-80C BASIC
                        *
0644 34   14              IN     PSHS X,B       Input a character do not wait
0646 AD   9F A000             JSR [RSIN]     Input character vector
064A 35   94                  PULS X,B,PC
                        * WAIT FOR K/B ENTRY
064C 34   14              INEEE  PSHS X,B
064E BD   27                  BSR CURS       Display a cursor
0650 AD   9F A000         INE    JSR [RSIN]     Input character vector
0654 27   FA                  BEQ INE
0656 BD   17                  BSR BS         Backspace
0658 BD   02                  BSR OUTEEE     Output echo the character
065A 35   94                  PULS X,B,PC
                        * OUTPUT A BYTE
065C 34   14              OUTEEE PSHS X,B
065E AD   9F A002             JSR [RSOUT]    Basic output vector
0662 35   94                  PULS X,B,PC
                        * OUTPUT A STRING
0664 A6   80              OUT    LDA 0,X+       Get character from string
0666 B1   04                  CMPA #4        Is it the number 4
0668 27   04                  BEQ OUT1       If so end
066A BD   F0                  BSR OUTEEE     Output the character
066C 20   F6                  BRA OUT
066E 39                   OUT1   RTS
                        * OUTPUT A BACKSPACE
066F 34   02              BS     PSHS A
0671 86   08                  LDA #$08       Backspace character
0673 BD   E7                BS1    BSR OUTEEE     Output it
0675 35   82                  PULS A,PC
                        * OUTPUT A CURSOR(BLACK)
0677 34   02              CURS   PSHS A
0679 86   F0                  LDA #$F0       Black cursor
067B 20   F6                  BRA BS1
                        * OUTPUT A CURSOR(RED)
067D 34   02              CURS1  PSHS A
067F 86   BF                  LDA #$BF       Red cursor
0681 20   F0                  BRA BS1
                        * OUTPUT A CURSOR(YELLOW)
0683 34   02              CURS2  PSHS A
0685 86   9F                  LDA #$9F       Yellow cursor
0687 20   EA                  BRA BS1
                        *
                        * SELECT ASCII OR BAUDOT
                        *
0689 30   8D 00B8 SPEED   LEAX MENU4,PCR Ask for the mode
068D 8D   D5              BSR OUT       Output menu
068F 8D   B8              BSR INEEE     Get response
0691 B1   41              CMPA #'A      Is it ASCII 110 Baud ?
0693 27   09              BEQ SPEED1
0695 6F   59              CLR MASK,U    Set baudot mask
0697 B1   42              CMPA #'B      Is it baudot
0699 27   00              BEQ SPEED2
069B 16   FF75            LBRA MONIT
                        * Set up for ASCII
069E 6C   59          SPEED1 INC MASK,U    Set mask to ASCII
06A0 16   FF70            LBRA MONIT
                        * SELECT BAUDOT SPEEDS
```

tages, like hardware time and date clocks and the ability to print text while receiving RTTY.

The second hardware choice is to do all the serial-to-parallel decoding in software and allow the computer to be attached to any available TU. This technique is the best for the consumer. The costs are much less in this choice, but the burden of the system's performance is placed on the back of the programmer. This type of programming is very difficult and separates casual programmers from professionals. To do this type of programming requires the patience of a saint and the determination of a bulldog.

I will describe here a program which uses the simple hardware concept and demonstrates some of the techniques which can be used in more elegant software. Hopefully, this article will perform three functions:

1) Be a teaching tool to show how simply RTTY can be programmed.

2) Demonstrate some of the programming techniques which place the 6809 processor in a class by itself.

3) Allow a ham with a limited budget and a minimum computer to get on RTTY for the least cash outlay.

The System

To receive RTTY on today's crowded ham bands requires some sort of hardware interface with good input filtering. This type of interface to the computer is called the TU, or terminal unit. This interface is used to remove adjacent channel interference and general background noise. The only requirement for this interface is that its output and input are compatible with standard RS-232 levels. RS-232 has no meaning other than that the voltage levels are greater than plus or minus 8 volts. The program listing assumes that the TU has RS-232 compatibility and attaches to the CoCo through its RS-232 port. Later in this article, a sche-

```
06A3 30   8D 008A  SPEED2 LEAX MENU5,PCR Ask for Baudot speed
06A7 8D   B8             BSR OUT
06A9 8D   A1             BSR INEEE
06AB B1   31             CMPA #'1        Is it 110 WPM
06AD 27   05             BEQ SPEED3
06AF 8D   08             BSR IN60        If not 100 WPM it must be 60 WPM
06B1 16   FF5F           LBRA MONIT
06B4 8D   21   SPEED3 BSR IN100      Set up 100 WPM
06B6 16   FF5A           LBRA MONIT
                         *
                         * INITALIZE SPEED CONSTANTS
                         *
                         * BAUDOT 60 WPM/ASCII 110
                         *
06B9 30   8D FF77  IN60   LEAX DEL2C,PCR 1'st character in table
06BD 31   8D 0587  IN60B  LEAY BRATR1,PCR Location to place constnts
06C1 C6   03             LDB #3          Three constants to move
06C3 34   04       IN60A PSHS B
06C5 EC   81             LDD 0,X++
06C7 ED   A1             STD 0,Y++
06C9 35   04             PULS B
06CB 5A                  DECB            Do it again
06CC 26   F5             BNE IN60A
06CE EC   8D FF78        LDD BAUDR,PCR 110 Baud ASCII
06D2 ED   8D 0578        STD BAUDA,PCR
06D6 39                  RTS
                         * BAUDOT 100 WPM
06D7 30   8D FF5F  IN100  LEAX DEL5C,PCR 1'st character in 100 WPM table
06DB 20   E0             BRA IN60B
                         *
                         * MENUS FOR BASIC SELECTIONS
                         * COPYWRITE AND SPEED
                         *
06DD 0D                  MENU   FCB $0D
06DE 52 54 54 59                FCC /RTTY PROGRAM/
06E2 20 50 52 4F
06E6 47 52 41 4D
06EA 0D                         FCB $0D
06EB 52 3D 52 45                FCC /R=RECEIVE,X=TRANSMIT/
06EF 43 45 49 56
06F3 45 2C 58 3D
06F7 54 52 41 4E
06FB 53 4D 49 54
06FF 0D                         FCB $0D
0700 43 4C 45 41                FCC /CLEAR=BASIC,S=SPEED/
0704 52 3D 42 41
0708 53 49 43 2C
070C 53 3D 53 50
0710 45 45 44
0713 0D 04                      FCB $0D,4
                         *
0715 0D                  MENU4  FCB $0D
0716 41 3D 31 31                FCC /A=110 BAUD ASCII/
071A 30 20 42 41
071E 55 44 20 41
0722 53 43 49 49
0726 0D                         FCB $0D
0727 42 3D 42 41                FCC /B=BAUDOT/
072B 55 44 4F 54
072F 0D 04                      FCB $D,4
                         *
0731 0D                  MENU5  FCB $0D
0732 31 3D 31 30                FCC /1=100 WPM,6=60 WPM/
0736 30 20 57 50
073A 4D 2C 36 3D
073E 36 30 20 57
0742 50 4D
0744 0D 04                      FCB $0D,4
                         *
0746 0D                  COPYR  FCB $0D
0747 28 43 29 20                FCC /(C) CLAYTON W ABRAMS,1981/
074B 43 4C 41 59
074F 54 4F 4E 20
0753 57 20 41 42
0757 52 41 4D 53
075B 2C 31 39 38
075F 31
0760 0D 04                      FCB $0D,4
                         ********************************
                         *
                         * ASCII TO BAUDOT LOOKUP TABLE
                         * Letters: ABCDEFGHIJKLMNOPQRSTUVWXYZ
                         *
0762 9C B0 C4 B4  LOU1   FCB $9C,$B0,$C4,$B4,$BC,$A4
0766 BC A4
0768 D0 E8 CC 94                FCB $D0,$E8,$CC,$94,$84,$D8
076C B4 D8
076E E0 E4 F0 C8                FCB $E0,$E4,$F0,$C8,$B8,$D4
0772 B8 D4
0774 AC F8 BC C0                FCB $AC,$F8,$BC,$C0,$98,$A0
0778 98 A0
077A A8 B8 00 00                FCB $A8,$B8,0,0,0,0,0,0
077E 00 00 00 00
                         * Figures: '"##%&'()$+,-./0123456789:;
0781 EC A4 B8 E8                FCB $EC,$A4,$B8,$E8,$84,$D0
```

```
0785 B4 D0
0787 D0 94 84 D8                FCB $D0,$94,$84,$D8,0,0
078B 00 00
078D E4 00 E0 A0                FCB $E4,0,$E0,$A0,$CB,$BB
0791 C8 BB
0793 9B BC D4 F8                FCB $9B,$BC,$D4,$F8,$AB,$BC
0797 A0 BC
0799 CC F0 C4 C0                FCB $CC,$F0,$C4,$C0
                         *
                         * BAUDOT TO ASCII
                         * LOOK UP TABLE
                         * Table order: KOU JWAXFYSBDZEVCPIGRL(1#.)MNH
                         * (sp)0(cr.)T  (17 '2-/!6(bell)7*"3;;09&4)(1#.).,8
                         * 9(cr.)5
                         *
079D 4B 51 55 00  UD1    FCB $4B,$51,$55,0,$4A,$57
07A1 4A 57
07A3 41 58 46 59                FCB $41,$58,$46,$59,$53,$42
07A7 53 42
07A9 44 5A 45 56                FCB $44,$5A,$45,$56,$43,$50
07AD 43 50
07AF 49 47 52 4C                FCB $49,$47,$52,$4C,$0A,$4D
07B3 0A 4D
07B5 4E 48 20 4F                FCB $4E,$48,$20,$4F,$0D,$54
07B9 0D 54
07BB 00 00 28 31                FCB 0,0,$28,$31,$37,0
07BF 37 00
07C1 2C 32 2D 2F                FCB $2C,$32,$2D,$2F,$21,$36
07C5 21 36
07C7 07 3F 24 22                FCB $07,$3F,$24,$22,$33,$3B
07CB 33 3B
07CD 3A 30 38 26                FCB $3A,$38,$3B,$26,$34,$29
07D1 34 29
07D3 0A 2E 2C 3B                FCB $0A,$2E,$2C,$3B,$20,$39
07D7 20 39
07D9 0D 35 00                   FCB $0D,$35,0
                         *
                         *
                         * FIND BAUDOT CODE
                         * ASCH=ASCII code to be converted
                         * BAUD=BAUDOT code which has been converted
                         *
07DC 34   16             FINDB  PSHS X,A,B
07DE A6   5E                    LDA ASCH,U      get the code
07E0 81   0D                    CMPA #$0D       is it carriage return?
07E2 27   20                    BEQ CR
07E4 81   0A                    CMPA #$0A       is it line feed ?
07E6 27   20                    BEQ LF
07E8 81   3F                    CMPA #$3F       is it a ?
07EA 27   20                    BEQ QUE
07EC 81   20                    CMPA #$20       is it a space ?
07EE 27   20                    BEQ SP
07F0 84   40                    ANDA #$40       test for letter
07F2 26   20                    BNE LET
07F4 A6   5E                    LDA ASCH,U
07F6 84   3F                    ANDA #$3F       must be a number mask upper bits
07F8 C6   01                    LDB #1          shift bit
07FA E7   5B                    STB LOU,U       save it
07FC 30   8D FF61               LEAX LOU1-1,PCR Base address of table minus one
0800 A6   86                    LDA A,X         find code indexed into table
0802 20   1C                    BRA RETA1       return too calling routine
0804 86   F4       CR          LDA #$F4        carriage return baudot code
0806 20   1C                    BRA RETA
0808 86   DC       LF          LDA #$DC        line feed baudot code
080A 20   18                    BRA RETA
080C 86   B0       QUE         LDA #$B0        question mark baudot code
080E 20   14                    BRA RETA
0810 86   EC       SP          LDA #$EC        space baudot code
0812 20   0A                    BRA RETA2
0814 A6   5E       LET         LDA ASCH,U      get back ascii character
0816 84   3F                    ANDA #$3F       mask out upper bits
0818 30   8D FF45               LEAX LOU1-1,PCR table base address
081C A6   86                    LDA A,X         find code offset into table
081E 6F   5B       RETA2       CLR LOU,U       clear current shift code
0820 A7   5D       RETA1       STA BAUD,U      store baudot code
0822 35   96                    PULS X,A,B,PC return to calling routine
0824 C6   01       RETA        LDB #1          shift code
0826 E7   5B                    STB LOU,U       save in current shift
0828 20   F6                    BRA RETA1
                         *
                         * FIND ASCII CODE
                         * BAUDOT code is placed in CODE at start
                         * ABCII code is placed into BAUD in completion at end
                         *
082A A6   5F             FINDA  LDA CODE,U      get baudot code
082C 44                         LSRA            align byte
082D 84   1F                    ANDA #$1F       mask out garbarge
082F 27   15                    BEQ LOW         if zero get out
0831 81   04                    CMPA #04        is it a shift ?
0833 27   17                    BEQ UP
0835 E6   5A                    LDB UD,U
0837 26   09                    BNE FINDA2
0839 30   8D FF5F  FINDA1 LEAX UD1-1,PCR base address of table
083D A6   86                    LDA A,X         find offset into table
083F A7   5D                    STA BAUD,U      store results
```

matic of a simple TU will be discussed which can be home-brewed at a low cost.

The only other necessary feature for the system is that the CoCo must have 4K or more RAM. Extended Tandy Basic is not required since the program is written in machine language. Attached to the computer must be a TV set for display and a tape recorder to save or load the program.

The Software

My seventh attempt at developing a RTTY program is shown in the program listing. This program can be keyed in directly from the listing in object form or keyed in in source form and assembled to create an object code. The object code is the actual machine-language programming which causes the computer to do its tricks. To key in a program, the left-hand column is the address in memory where the instruction is stored. The following bytes are the actual bytes in memory. For example, the RTTY program's first instruction is 1F and is loaded into memory at address 0600. To key in a program like this requires the use of a second program called a monitor. You can obtain a monitor program from commercial sources or write your own in Basic. One of the most important features of the RTTY program is that it can be saved anywhere in the CoCo's memory without changes. This means that you can key the program into address 1000 or 2000 hex and it will run without changes. The 6809 microprocessor is the only computer which allows you to do this. All other processors require that the program must be reassembled at another address to make it run. This feature is called Position Independent Code.

To understand how to write a program to take advantage of this feature is a little difficult. I'll try to point out how it is done as I proceed through the program description.

```
0041 39          FINDA4 RTS             return to calling routine
0042 8A   20     FINDA2 ORA #$20
0044 20   F3            BRA FINDA1
0046 6F   5A     LOW    CLR UD,U        lower case
0048 6F   5D            CLR BAUD,U
004A 20   F5            BRA FINDA4
004C 86   FF     UP     LDA #$FF        upper case
004E A7   5A            STA UD,U
0050 6F   5D            CLR BAUD,U
0052 20   ED            BRA FINDA4
0054 6F   5D     FINDA3 CLR BAUD,U
0056 20   E9            BRA FINDA4
                 *
                 * TRANSMIT SUBROUTINE
                 * This routine takes a character in ASCH
                 * and transmitts it via the RS-232 port on the
                 * computer
                 *
0058 6D   59     TRTTY  TST MASK,U      is it ASCII or BAUDOT
005A 1026 0262           LBNE ASCII0    if it is not zero it's ASCII
005E 17   FF7B           LBSR FINDB     find the baudot code
0061 8D   32     TRTTY1 BSR UL          look for upper lower case shift
0063 5F                 CLRB           clear bit counter
0064 48          TR2    ASLA           shift xmit bit into carry
0065 25   04            BCS TR3        if carry is set xmit a space
0067 8D   20             BSR MARK       if carry off xmit a mark
0069 20   02            BRA TR4
006B 8D   10     TR3    BSR SPACE      xmit a space
006D 5C          TR4    INCB           increment bit counter
006E C1   06            CMPB #6        is it six bits
0070 27   02            BEQ TR5        if so send stop bit
0072 20   F0            BRA TR2        do it all over again
0074 86   02     TR5    LDA #$02       place RS-232 low
0076 B7   FF20          STA PIA        execute
0079 17   00C1          LBSR DEL3      delay stop bit time
007C 39                 RTS
                 *
                 * XMIT A SPACE
                 *
007D 34   06     SPACE  PSHS A,B
007F 86   00            LDA #0         make RS-232 high
0081 B7   FF20          STA PIA        execure
0084 17   00A9          LBSR DEL2      delay a bit time
0087 35   06            PULS A,B,PC
                 *
                 * XMIT A MARK
                 *
0089 34   06     MARK   PSHS A,B
008B 86   02            LDA #2         make RS-232 low
008D B7   FF20          STA PIA        execute
0090 17   009D          LBSR DEL2      delay a bit time
0093 35   06            PULS A,B,PC
                 *
                 * UPPER LOWER CASE SHIFT
                 *
0095 E6   5B     UL     LDB LOU,U      get current shift status
0097 E8   5C            EORB LAST,U    compare it with the last status
0099 26   02            BNE UL1        they are different
009B 20   0F            BRA UL4
009D 86   40     UL1    LDA #$40       test for letter
009F A5   5E            BITA ASCH,U
00A1 26   0C            BNE UL2        if not branch
00A3 86   90            LDAA #$90      letter shift
00A5 5F                 CLRB
00A6 8D   BC            BSR TR2
00A8 86   01            LDA #1
00AA A7   5C     UL3    STA LAST,U     update new last
00AC A6   5D     UL4    LDA BAUD,U
00AE 39                 RTS
00AF 86   80     UL2    LDA #$80       figure shift
00B1 5F                 CLRB
00B2 8D   B0            BSR TR2
00B4 4F                 CLRA
00B5 20   F3            BRA UL3
                 *
                 * RECEIVE RTTY
                 * MAIN LINE
                 *
00B7 30   8D 000E RECV   LEAX MENU1,PCR receive menu
00BB 17   FDA6           LBSR OUT       output menu
00BE 6D   59             TST MASK,U     test for ASCII
>00C0 1026 005C          LBNE RECT4     receive ASCII
00C4 8D   23             BSR RECT1      receive and display characters
00C6 16   0086           LBRA FIFO      now transmit
                 *
00C9 0D          MENU1  FCB $0D
00CA 52 45 43 45         FCC /RECEIVE RTTY/
00CE 49 56 45 20
00D2 52 54 54 59
00D6 0D                  FCB $0D
00D7 41 4E 59 20         FCC /ANY KEY=TRANSMIT/
00DB 4B 45 59 3D
00DF 54 52 41 4E
00E3 53 4D 49 54
00E7 0D 04               FCB $0D,4
                 *
                 * RECEIVE ROUTINE
                 *
00E9 17   FD58   RECT1  LBSR IN         look for a keyboard input
00EC 26   1E             BNE RECT3      if any end receive
00EE B6   FFF2           LDA PIA2       get RS-232 input
                         ANDA #1        mask out garbarge
00F3 26   F4             BNE RECT1      if nothing look for keyboard
                 * some thing has been received
00F5 6F   5F             CLR CODE,U     clear conversion byte
00F7 8D   4D             BSR DEL4       delay 1/2 data bit time
00F9 C6   06             LDB #6         six bits
00FB 8D   10     RECT2   BSR RECTB      input a byte
00FD 5D                  TSTB
00FE 26   FB             BNE RECT2      if zero do it again
0100 17   FF27           LBSR FINDA     convert byte to ASCII
0103 A6   5D             LDA BAUD,U     results in A
0105 17   FD54           LBSR OUTEEE    output it
0108 8D   33             BSR DEL3       stop bit delay
010A 20   DD             BRA RECT1
010C 39          RECT3  RTS
                 *
                 * INPUT A BAUDOT BYTE
                 *
010D B6   FFF2   RECTB  LDA PIA2        get RS232 input
0110 84   01            ANDA #1        mask out other bits
0112 27   08            BEQ RECTB1     if on shift in a bit
0114 68   5F     RECTB2 ASL CODE,U     shift the whole mess left
0116 5A                 DECB           decrement bit counter
0117 27   02            BEQ RECTB3     last bit
0119 8D   15            BSR DEL2       delay a data bit time
011B 39          RECTB3 RTS
011C 6C   5F     RECTB1 INC CODE,U     add a bit to byte
011E 20   F4            BRA RECTB2
                 *
                 * RECEIVE ASCII
                 *
0120 17   FD21   RECT4  LBSR IN         look for keyboard input
0123 26   0B            BNE RECT5      if a key has been struck get out
0125 17   01D1          LBSR ASCII     get ASCII charactre
0128 17   FD31          LBSR OUTEEE    display it
012B 20   F3            BRA RECT4      do it all over agin
>012D 16   001F  RECT5  LBRA FIFO      now go to transmit mode
                 *
                 * DELAY ROUTINES
                 * DEL4=1/2 DATA BIT
                 * DEL3=STOP BIT
                 * DEL2=DATA BIT
                 *
0130 34   04     DEL2   PSHS B
0132 10AE 8D 0311       LDY BRATR1,PCR
0137 31   3F     DEL    LEAY -1,Y
0139 26   FC            BNE DEL
013B 35   04            PULS B,PC
                 *
013D 34   04     DEL3   PSHS B
013F 10AE 8D 0306       LDY BRATR2,PCR
0144 20   F1            BRA DEL
                 *
0146 34   04     DEL4   PSHS B
0148 10AE 8D 02FF       LDY BRATD,PCR
014D 20   EB            BRA DEL
                 *
                 *
                 * TRANSMITT BUFFER
                 *
014F 30   8D 00BC FIFO   LEAX MENU2,PCR xmit menu
0153 17   FD0E           LBSR OUT       output it
0156 17   FCEB   FIFO1  LBSR IN         look for keyboard input
0159 27   FB             BEQ FIFO1      if none do it again
015B 81   0D             CMPA #$0D      is it a carriage return
015D 27   1E             BEQ FIFO5      if so go to
015F 81   0C             CMPA #$0C      is it CLEAR key ?
0161 1027 FCAE           LBEQ MONIT     go to main line monitor
0165 81   3C             CMPA #$3C      if < key send CW ID
0167 1027 01C6           LBEQ MAINC
016B 81   2B             CMPA #$2B      if + load station buffers
016D 1027 00F7           LBEQ STATB
0171 81   3E             CMPA #$3E      if >  xmit station buffer
0173 27   42             BEQ FIF2
0175 81   3D             CMPA #$3D      if = send RYRY
0177 27   0F             BEQ FIFO7
0179 8D   2B     FIFO6  BSR FXMT        xmit a character on RTTY
017B 20   D9             BRA FIFO1
                 * Carriage Return has been sent
017D 86   0A     FIFO5  LDA #$0A        line feed
017F A7   5E             STA ASCH,U
0181 17   FED4           LBSR TRTTY     xmit it
0184 86   0D             LDA #$0D       carriage return
0186 20   F1             BRA FIFO6
                 * Xmit 15 RY's
0188 86   0A     FIFO7  LDA #$0A        line feed
018A A7   5E             STA ASCH,U
018C 17   FEC9           LBSR TRTTY
018F 86   0D             LDA #$0D       carriage return
```

Program Description

The program was written to perform three functions: receive RTTY, transmit RTTY, and issue a CW ID at the end of a transmission. Each of the functions can be broken down further into smaller parts which change RTTY speeds, allow for program option selections, and do general housekeeping. Before jumping into the description of these various functions, let's discuss how the program achieves position independence. I'll next go into each of the functional program parts.

Position Independence. The RTTY program uses two means to achieve program position independence. The first technique is use of the user stack, or U register. The user stack is similar to the system stack, but it can be used in the 6809 for two purposes. One use is as a third index register. The U stack can also be used as a pointer in memory for the storage of program variables. This is how U is used in this program. When the program is first executed, the system stack is placed slightly below the user stack. This system stack position is determined by Tandy Basic and varies as a function of the size of memory. Typically, it is in the upper 256 bytes of available memory. If program variables are referred to by this pointer, their position in real memory can be variable. Some of the variables in the RTTY program use this technique.

The second technique is the use of the LEA or Load Effective Address instruction. This instruction allows for an index register to be loaded with the address of a program variable relative to the program counter (PCR) wherever it may be in memory. For example, the LEAX MENU,PCR will load the address of MENU into the X register. The PCR portion of the instruction means that the load is relative to the location in memory where the program is currently exe-

```
0991 8D   13            BSR FXMT
0993 C6   0F            LDB #15         15 characters
0995 34   04    FIFOB   PSHS B
0997 86   52            LDA #'R         ascii R
0999 8D   0B            BSR FXMT        xmit it
099B 86   59            LDA #'Y         ascii Y
099D 8D   07            BSR FXMT        xmit it
099F 35   04            PULS B
09A1 5A                 DECB
09A2 26   F1            BNE FIFOB
09A4 20   B0            BRA FIFO1       go back to polling routine
                * GENERAL TTY XMIT
09A6 A7   5E    FXMT    STA ASCH,U
09A8 17   FEAD          LBSR TRTTY      send it on rtty
09AB 17   FCC1          LBSR BS         output a backspace
09AE A6   5E            LDA ASCH,U
09B0 17   FCA9          LBSR OUTEEE     ascii character last xmitted
09B3 17   FCC7          LBSR CURS1      output a cursor
09B6 39                 RTS
                *
                * STATION BUFFER XMIT
                *
09B7 30   8D 0098 FIF2  LEAX MENU6,PCR station buffer menu
09BB 17   FCA6          LBSR OUT        send it out
09BE 17   FC8B          LBSR INEEE      get input character
09C1 81   33            CMPA #'3        is it higher than 3
09C3 22   F2            BHI FIF2        if so not valid
09C5 81   30            CMPA #'0        is it zero ?
09C7 27   2B            BEQ FIF6        get buffer 0 addres
09C9 84   0F            ANDA #$0F       mask out high of buffer number
09CB 30   8D 0291       LEAX BUF0,PCR buffer base address
09CF 30   89 00FF FIF5  LEAX 255,X      find address of buffer
09D3 4A                 DECA            decrement number
09D4 26   F9            BNE FIF5
                * XMIT BUFFER SELECTED
09D6 A6   80    FIF3    LDA 0,X+        get bufer byte
09D8 34   02            PSHS A          save it
09DA A7   5E            STA ASCH,U
09DC 17   FC7D          LBSR OUTEEE     display it
09DF 8D   19            BSR TRTTC
09E1 17   FC60          LBSR IN         look for input character
09E4 26   09            BNE FIF4
09E6 35   02            PULS A
09E8 81   1B            CMPA #$1B       is it the buffer end ?
09EA 26   EA            BNE FIF3
09EC 16   FF67          LBRA FIFO1
09EF 35   02    FIF4    PULS A
09F1 16   FF62          LBRA FIFO1
                * SELECT BUFFER 0
09F4 30   8D 026B FIF6  LEAX BUF0,PCR address of buffer 0
09F8 20   DC            BRA FIF3
                *
                * IF ONLY A CR IS INPUTTED A LF WILL BE ISSUED
                *
09FA A6   5E    TRTTC   LDA ASCH,U
09FC 81   0D            CMPA #$D        is it a CR
09FE 27   04            BEQ TRTTC1
0A00 17   FE55          LBSR TRTTY
0A03 39                 RTS
0A04 17   FE51  TRTTC1  LBSR TRTTY
0A07 86   0A            LDA #$A         LF
0A09 A7   5E            STA ASCH,U
0A0B 17   FE4A          LBSR TRTTY
0A0E 39                 RTS
                *
                * MENU FOR TRANSMITT
                *
0A0F 0D         MENU2   FCB $0D
0A10 54 52 41 4E        FCC /TRANSMIT RTTY,CLEAR=MONIT/
0A14 53 4D 49 54
0A18 20 52 54 59
0A1C 59 2C 43 4C
0A20 45 41 52 3D
0A24 4D 4F 4E 49
0A28 54
0A29 0D                 FCB $0D
0A2A 3C                 FCB $3C
0A2B 3D 43 57 20        FCC /=CW ID,/
0A2F 49 44 2C
0A32 2B                 FCB $2B
0A33 3D 4C 4F 41        FCC /=LOAD S BUF/
0A37 44 20 53 20
0A3B 42 55 46
0A3E 0D                 FCB $0D
0A3F 3E                 FCB $3E
0A40 3D 58 4D 49        FCC /=XMIT S BUF,/
0A44 54 20 53 20
0A48 42 55 46 2C
0A4C 3D                 FCB $3D
0A4D 3D 52 59           FCC /=RY/
0A50 0D                 FCB $0D
0A51 20 04              FCB $20,4
                *
0A53 000D       MENU6   FDB $0D
0A55 53 45 4C 20        FCC /SEL BUFFER 0-2 ?/
0A59 42 55 46 46
0A5D 45 52 20 30
0A61 2D 32 20 3F
0A65 0D 0A 04           FCB $D,$A,4
                *
                * STATION BUFFER LOAD
                *
0A68 30   8C E8 STATB   LEAX MENU6,PCR menu for station buffer load
0A6B 17   FBF6          LBSR OUT        output menu
0A6E 17   FB0B          LBSR INEEE      get keyboard input
0A71 81   32            CMPA #'2        is it buffer 2 or higher
0A73 22   F3            BHI STATB
0A75 81   30            CMPA #'0        is it buffer 0
0A77 27   37            BEQ STATB4
0A79 84   0F            ANDA #$0F       mask out high bits
0A7B 30   8D 01E1       LEAX BUF0,PCR buffer 0 address
0A7F 1F   09            TFR A,B
0A81 30   89 00FF STATB3 LEAX 255,X     find buffer address
0A85 4A                 DECA
0A86 26   F9            BNE STATB3
                * NOW LOAD THE BUFFER
0A88 C1   02            CMPB #2         is it the short buffer ?
0A8A 27   2A            BEQ STATB6      load this one
0A8C C6   FE    STATB5  LDB #254        buffer size
0A8E 17   FB8B  STATB1  LBSR INEEE      get character to be inputted
0A91 34   16            PSHS A,B,X
0A93 A7   5E            STA ASCH,U
0A95 17   FF62          LBSR TRTTC      check for CR or LF
0A98 35   16            PULS A,B,X
0A9A A7   80            STA X+          put it in RAM
0A9C 81   0C            CMPA #$0C       is it a CLEAR key
0A9E 27   09            BEQ STATB2      if so terminate entry
0AA0 5A                 DECB            decrement byte counter
0AA1 27   06            BEQ STATB2      if last byte end
0AA3 81   08            CMPA #$08       is it a backspace ?
0AA5 27   13            BEQ STATB7      if so whipe out character
0AA7 20   E5            BRA STATB1
0AA9 86   1B    STATB2  LDA #$1B        place last byte terminator
0AAB A7   1F            STA -1,X        decrement location counter
0AAD 16   FE9F          LBRA FIFO       go back to main line
                * SET UP FOR BUFFER 0
0AB0 30   8D 01AC STATB4 LEAX BUF0,PCR address of buffer 0
0AB4 20   D6            BRA STATB5
                * MAKE BUFFER 2 SHORT
0AB6 C6   7D    STATB6  LDB #125        short buffer
0AB8 20   D4            BRA STATB1
                * REMOVE LAST CHAR FROM BUFFER
0ABA 30   1E    STATB7  LEAX -2,X
0ABC 5C                 INCB
0ABD 5C                 INCB
0ABE 20   CE            BRA STATB1
                *
                * OUTPUT AN ASCII BYTE ON RTTY
                *
0AC0 34   17    ASCIO   PSHS X,B,A,CC
0AC2 A6   5E            LDA ASCH,U      get character
0AC4 5F                 CLRB            clear bit counter
0AC5 F7   FF20          STB PIA         stop bit on PIA
0AC8 C6   08            LDB #8          8 bit ASCII
0ACA 34   06            PSHS B,A
0ACC EC   8D 017E ASCIO1 LDD BAUDA,PCR bit delay
0AD0 83   0001  ASCIO2  SUBD #1         decrement it
0AD3 26   FB            BNE ASCIO2      do it again
0AD5 64   E4            LSR 0,S         shift ascii byte on the stack
0AD7 59                 ROLB            put shifted bit in
0AD8 59                 ROLB            RS-232 output bit location
0AD9 F7   FF20          STB PIA         ship it to interface
0ADC 6A   61            DEC 1,S         decrement bit counter
0ADE 26   EC            BNE ASCIO1      is it the last bit ?
0AE0 32   62            LEAS 2,S        if so un screw stack
0AE2 8D   0B            BSR ASDEL       delay bit time
0AE4 C6   02            LDB #2          stop bit
0AE6 F7   FF20          STB PIA         ship it to pia
0AE9 8D   04            BSR ASDEL       delay bit time
0AEB 8D   02            BSR ASDEL       twice for stop bit
0AED 35   97            PULS PC,X,B,A,CC
                *
                * ASCII DELAY
                *
0AEF EC   8D 015B ASDEL   LDD BAUDA,PCR bit delay
0AF3 83   0001  ASDEL1  SUBD #1
0AF6 26   FB            BNE ASDEL1
0AF8 39                 RTS
                *
                * INPUT AN ASCII BYTE
                *
0AF9 34   15    ASCII   PSHS X,B,CC
0AFB B6   FF22  ASCII1  LDA PIA2        Get input from RS-232
0AFE 47                 ASRA            Look to see if interface is on
0AFF 24   FA            BCC ASCII1      If low keep looking
0B01 B6   FF22  ASCII2  LDA PIA2        Look again
0B04 47                 ASRA            Shift received bit into carry
0B05 25   FA            BCS ASCII2
0B07 EC   8D 0143       LDD BAUDA,PCR Bit time delay
0B0B 44                 LSRA
```

cuting. This programming technique allows the program to be moved around in memory.

General Housekeeping. When the program is first executed, the start routine sets up RAM delay constants, places a message on the screen, and asks for a CW ID to be transmitted. The CW ID can consist of up to 15 characters. As each character is entered into the keyboard, it is translated to CW and placed in a buffer at the end of the program called BUF. Next, the primary menu is flashed on the screen of the CoCo. This menu allows for the selection of receive, transmission, or speed selections.

All communications to and from the program are through INEEE, OUT, and OUTEEE routines. These routines use the standard Radio Shack I/O vectors in the Basic ROM. It would be possible to change these vectors to any 6809 system and the program will function.

RTTY Receive. RTTY can be received by the program as either 8-bit ASCII without parity or 5-bit Baudot. Either mode can be selected by the SPEED routine. When the program is first initialized, a speed of 60-wpm Baudot is selected. This is accomplished by the IN60 routine which adds the appropriate constants to BRATR1,2 and BRATD.

To receive RTTY, the mainline routine RECV is selected. When selected, the routine first checks to see if ASCII or Baudot is chosen. This is accomplished by checking MASK. If this value is zero, the mode is Baudot; if anything else, the mode is ASCII.

The mainline Baudot receive routine is RECT1, and ASCII is RECT4. These routines continuously receive RTTY and display the results on the screen until a key is struck on the keyboard. The ASCII routine has a little abnormality in that once it is selected, either a signal or

```
0B0C 59                 ROLB            Divide bit time by 2
0B0D 83  0001           SUBD #1
0B10 83  0001   ASCII3  SUBD #1
0B13 2E  F8             BGT ASCII3
0B15 C6  08             LDB #8          Set for 8 bit ASCII
0B17 34  06             PSHS B,A        Put bit count delay on stack
0B19 EC  8D 0131 ASCII5 LDD BAUDA,PCR   Get delay time again
0B1D 83  0001   ASCII6  SUBD #1         Count it down
0B20 26  FB             BNE ASCII6      Equalize times
0B22 12                 NOP
0B23 F6  FF22           LDB PIA2        Get input again
0B26 54                 LSRB            Is the input off or on
0B27 66  E4             ROR #,S         Shift the carry on to the stack
0B29 6A  61             DEC 1,S         Decrement the bit counter
0B2B 26  EC             BNE ASCII5      If not 8 do it all over again
0B2D 35  06             PULS B,A        Restore the stack
0B2F 35  95             PULS PC,X,B,CC A reg has received byte
                        *
                        * ROUTINE TO XMIT
                        * CW ID
                        *
0B31 30  8D 011B MAINC  LEAX BUF,PCR    CW ID menu
0B35 A6  80     MAINC1  LDA #,X+        Get a byte from the buffer
0B37 27  1E             BEQ MAINC2      If zero issue a CW space
0B39 81  FF             CMPA #$FF       If last return to main line
0B3B 1027 FAD4          LBEQ MONIT
0B3F 8D  05             BSR CW          Send the CW character
0B41 17  FB3F           LBSR CURS2      Place the new cursor on the screen
0B44 20  EF             BRA MAINC1
                        *
                        * XMIT CW
                        *
0B46 1F  89     CW      TFR A,B         Save a copy of char in B
0B48 C4  07             ANDB #$07       Set B to 0 of bit to xmit
0B4A 4B         CW1     ASLA            Shift xmit bit to carry
0B4B 25  2A             BCS DASH        If on its a dash
0B4D 8D  3C             BSR DOT
0B4F 5A         CW2     DECB            Decrement bits to xmit
0B50 27  02             BEQ END1        If last end
0B52 20  F6             BRA CW1         Keep xmitting
0B54 8D  05     END1    BSR DELA1
0B56 39                 RTS
                        *
0B57 8D  17     MAINC2  BSR SPACE1      Xmit a space
0B59 20  DA             BRA MAINC1
                        *
                        * DASH DELAY
0B5B 86  03     DELA1   LDA #3          Dash 3X that of a dot
0B5D 8D  07     CDEL1   BSR CDL1        Dot delay
0B5F 4A                 DECA
0B60 26  FB             BNE CDEL1
0B62 39                 RTS
                        * DOT DELAY
0B63 8D  01     DELA2   BSR CDL1
0B65 39                 RTS
                        * DELAY LOOP FOR CW
0B66 10AE 8D FAD5 CDL1  LDY CWDEL,PCR CW delay constant
0B6B 31  3F     CDL2    LEAY -1,Y
0B6D 26  FC             BNE CDL2
0B6F 39                 RTS
                        * SPACE DELAY
0B70 8D  E9     SPACE1  BSR DELA1       Delay 7 times as long as dot
0B72 8D  E7             BSR DELA1
0B74 8D  ED             BSR DELA2
0B76 39                 RTS
                        * DASH TRANSMISSION
0B77 34  06     DASH    PSHS A,B
0B79 86  08             LDA #8          Turn RS-232 on
0B7B B7  FF20           STA PIA
0B7E 8D  DB             BSR DELA1       Delay dash time
0B80 86  02             LDA #2          Turn RS-232 off
0B82 B7  FF20           STA PIA
0B85 8D  DC             BSR DELA2
0B87 35  06             PULS A,B
0B89 20  C4             BRA CW2
                        * DOT TRANSMISSION
0B8B 34  06     DOT     PSHS A,B
0B8D 86  08             LDA #8          Turn on
0B8F B7  FF20           STA PIA
0B92 8D  CF             BSR DELA2
0B94 86  02             LDA #2          Turn off
0B96 B7  FF20           STA PIA
0B99 8D  CB             BSR DELA2
0B9B 35  86             PULS A,B,PC
                        *
                        * LOAD CW BUFFER WITH
                        * STATION ID
                        *
0B9D 30  8D 0076 CWL    LEAX MENU3,PCR Load buffer menu
0BA1 17  FAC8           LBSR OUT       Send it out
0BA4 30  8D 00A8        LEAX BUF,PCR   Get buffer base address
0BA8 C6  0F             LDB #15        Max buffer size
0BAA 34  04             PSHS B
0BAC 17  FA9D   CWL1    LBSR INEEE     Get keyboard input
0BAF 1F  89             TFR A,B        Save a copy in B
0BB1 81  0D             CMPA #$0D      Is it a return ?
0BB3 27  37             BEQ CWL5       If so terminate entry
0BB5 C4  30             ANDB #$30      Is it a number ?
0BB7 C1  30             CMPB #$30
0BB9 27  1C             BEQ CWL2       If so go to number
                        * LETTER DECODE
0BBB 81  20             CMPA #$20      Is it a space?
0BBD 27  26             BEQ CWL6       Enter a space
0BBF 81  2F             CMPA #$2F      Is it a slash?
0BC1 27  25             BEQ CWL3
0BC3 31  8D 002C        LEAY TABCH,PCR Base address of conversion table
0BC7 84  1F             ANDA #$1F      Mask out high bits
0BC9 4A                 DECA           Adjust for look up table
0BCA A6  A6             LDA A,Y        Find CW character
0BCC A7  80     CWL4    STA #,X+       Save it in buffer
0BCE 35  04             PULS B
0BD0 5A                 DECB           Decrement the character count
0BD1 27  19             BEQ CWL5       If last terminate
0BD3 34  04             PSHS B
0BD5 20  D5             BRA CWL1       Get next character
                        * NUMBER DECODE
0BD7 84  0F     CWL2    ANDA #$0F      Mask out all but significant bits
0BD9 81  09             CMPA #9        Is it 9 or ASCII 39
0BDB 22  08             BHI CWL6       If greater it is not a number
0BDD 31  8D 002C        LEAY TABNUM,PCR Base address of number
0BE1 A6  A6             LDA A,Y        Find CW character
0BE3 20  E7             BRA CWL4
                        * SPACE
0BE5 4F         CWL6    CLRA           Place a space in the buffer
0BE6 20  E4             BRA CWL4
                        * SLASH
0BE8 86  95     CWL3    LDA #$95       Place a slash in the buffer
0BEA 20  E0             BRA CWL4
                        * END OF ENTRYS
0BEC 86  FF     CWL5    LDA #$FF       Last entry into table
0BEE A7  84             STA #,X
0BF0 16  FA20           LBRA MONIT
                        * CW CHARACTER LOOKUP TABLE
                        * characters: ABCDEFGHIJKLMNOPQRSTUVWXYZ
0BF3 42 84 A4 83 TABCH  FCB $42,$84,$A4,$83,$81,$24,$C3,$84
0BF7 81 24 C3 24
0BFB 82 74 A3 24        FCB $82,$74,$A3,$24,$C2,$82,$E3,$64
0BFF C2 82 E3 64
0C03 D4 43 03 B1        FCB $D4,$43,$03,$B1,$23,$14,$63,$94,$B4,$C4
0C07 23 14 63 94
0C0B B4 C4

                        * NUMBER TABLE
                        * characters: 0123456789
0C0D FD 7D 3D 1D TABNUM FCB $FD,$7D,$3D,$1D,$8D,$85,$85,$C5
0C11 8D 85 85 C5
0C15 E5 F5              FCB $E5,$F5
                        *
0C17 0D         MENU3   FCB $0A0D
0C18 43 57 20 49        FCC /CW ID LOAD, TYPE CALL/
0C1C 44 20 4C 4F
0C20 41 44 2C 20
0C24 54 59 50 45
0C28 20 43 41 4C
0C2C 4C
0C2D 0D                 FCB $0A0D
0C2E 31 35 20 43        FCC /15 CHAR MAX,ENTER TO END/
0C32 48 41 52 20
0C36 4D 41 58 2C
0C3A 45 4E 54 45
0C3E 52 20 54 4F
0C42 20 45 4E 44
0C46 0D 04              FCB $0D,4
                        ********************************************************
                        *   IF THIS PROGRAM IS TO BE PLACED ON EPROM
                        *   AN ORG SHOULD BE ASSEMBLED INTO THE PROGRAM
                        *   TO PLACE THESE CONSTANTS IN MICROPROCESSOR RAM
                        ********************************************************
                        *       ORG    XXXX       FOR EPROM OPERATION
                        *
                        * RAM CONSTANTS
                        *
0C48 0000       BRATR1  FDB #           Baud rate constants
0C4A 0000       BRATR2  FDB #
0C4C 0000       BRATD   FDB #
0C4E 0000       BAUDA   FDB #
                        *
                        * CW CHARACTER BUFFER
                        *
0C50            BUF     RMB 16          CW xmit buffer
                        *  STATION BUFFERS
0C60 1B         BUF0    FCB $1B         End of buffer
0C61                    RMB 254         Buffer size
0D5F 1B         BUF1    FCB $1B
0D60                    RMB 254
0E5E 1B         BUF2    FCB $1B
0E5F                    RMB 125
                        *
                        END START

# ERROR(S) DETECTED
```

more input data will allow deselection of the routine while pressing a key.

The receive routines function by sampling the RS-232 input and looking to see if the port is high or low. If software delay is executed, you can sample, delay, then sample again for all data bits. If the bit is off, it is a data bit; if on, it is not a data bit. As each bit is received, a data byte is formed in which the results are stored. When complete, this data byte can be displayed on the screen or converted to ASCII from Baudot and then displayed.

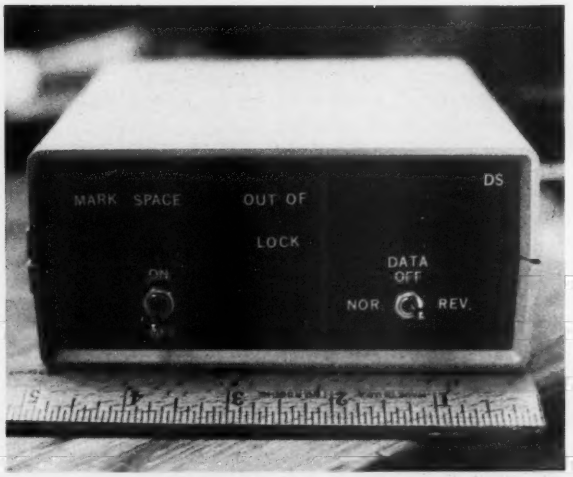
The Baudot-to-ASCII conversion routine is located at FINDA. The routine expects the Baudot code to be stored in CODE. The routine takes the Baudot byte, masks out the high-order bits, and adds the results to an address located in the X register. The address in the X register is the base address of UD1, which is the look-up table. This table is organized to allow the byte to control program flow based upon the Baudot code received. After completion, this routine places the resultant ASCII code in a variable called BAUD. To add a few complications to this process, some tests must be made to determine if the Baudot is uppercase or lowercase. This is accomplished by checking the UD value in RAM. This value determines whether the Baudot character is a figure or a letter.

Transmit RTTY. If you understood receive RTTY, then transmit should be easy. This technique is the opposite of receive. The mainline routine for transmission is FIFO. This routine normally stays in a polling state looking for a keyboard input. If the input is a special character, any one of five different functions can be selected. If the keyboard entry is a standard character, then it will be transmitted. The five possible functions are:

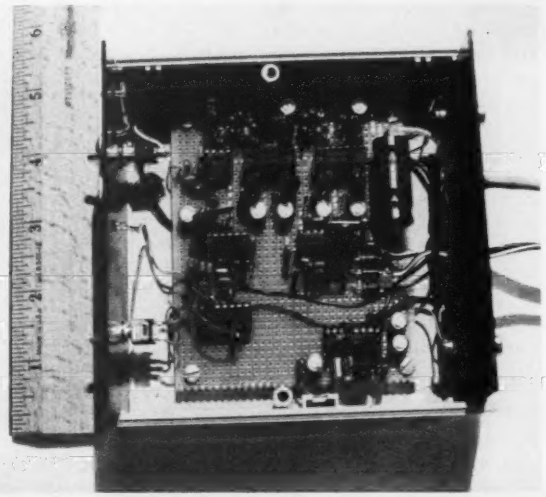
- Clear key—Return to mainline routine.

Parts List

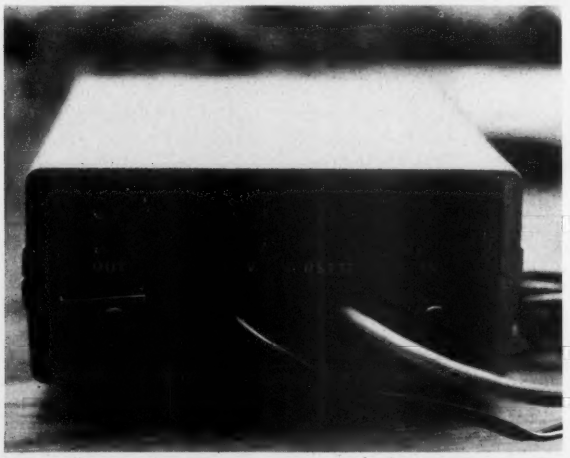
Qty.	Item	Qty.	Item	Qty.	Item
1	LM317MP regulator	2	6.2k	1	.047-uF ceramic
2	LM1458 op amp	10	10k	15	.1-uF ceramic
2	LM348 op amp	1	15k	1	1-uF 15-V electrolytic
1	4011B CMOS	1	18k	2	10-uF 15-V electrolytic
1	XR2206 function generator	1	22k	1	470-uF 25-V electrolytic
1	XR2211 AFSK demodulator	2	39k	12	.01-uF mylar™
2	2N3904 transistor (see options)	1	47k	1	.022-uF mylar
1	2N3906 transistor (see options)	5	51k	1	.047-uF mylar
3	LED light-emitting diode	1	62k		
7	1N4148 signal diode	7	100k	1	0-50-uA meter (see options)
4	1N4001 rectifier	1	180k		
		7	220k	1	SPDT switch (power)
6	120-Ohm resistor	2	470k	1	SPST switch, center-off (data)
1	220	1	1 meg		
3	330	6	100-Ohm trimpot	4	RCA style jack (input, output, optional scope)
1	620	3	5k trimpot		
4	1k	1	10k trimpot	1	12-V 250-mA wall transformer (Jameco AC250)
1	2.2k				
1	2.7k	1	.001-uF ceramic	1	Box, Radio Shack 270-218
1	5.1k	1	.005-uF ceramic		
		1	.01-uF ceramic	2	cable strain relief for RS-232 and power wires



Front view of interface.



Inside view of interface. Assembly was done using small-style capacitors and the resistors are mounted vertically. Wiring is point-to-point. Perfboard material is similar to Vector CIRCBORD 8002.



Rear view of interface. Jacks for optional scope monitor are not installed.

AMATEUR AND COMMERCIAL COMMUNICATION SERVICES

**Technical assistance by F.C.C. licensed technicians using the finest repair, test, and alignment equipment to give you results you can count on.

•REPAIRS •TESTS •INSTALLATIONS
•ALIGNMENTS •MODIFICATIONS •EVALUATIONS

**F.C.C. Licenses;
•General Radiotelephone (ship radar endorsed)
•Second Class Radiotelegraph (ship radar and aircraft radiotelegraph endorsed)
•Amateur Extra Class

MasterCard VISA

PARSEC COMMUNICATIONS

(517) 627-2650 (8 am to 6 pm)
(517) 627-2879 (6 pm to 10 pm) (est)
12325 Madonna Dr, Lansing, MI 48917
Geff N8CE

See List of Advertisers on page 114

- Less-than key—Xmit a CW ID.
- Plus key—Load station buffers.
- Greater-than key—Xmit station buffers.
- Equal key—Xmit 15 RYs.

Let's continue on the RTTY transmit before discussing the other functions. When a character is to be transmitted, the FXMT routine is called. This routine places the ASCII character from the keyboard entry into ASCH and then calls the TRTTY routine. This routine first determines if the character is to be transmitted as ASCII or Baudot. If it is Baudot, the FINDB routine is next called. This routine functions in a similar manner as FINDA. Once the Baudot character is found, a test determines if an upper- or lowercase shift should be made. This is accomplished by the UD routine. A comparison is made with the last shift sent and, if necessary, another shift is made to the opposite sense. Upon completion of this test, the Baudot bits are shifted into the carry and transmitted as RTTY. Between each shift, a delay is made to adjust to the correct speed.

If ASCII characters are to be sent, the ASCIO routine is called and the ASCII keyboard entry is transmitted directly as RTTY.

Returning to the five option selections, they can be summarized as follows. The CW ID is transmitted by the CW routine. This routine functions similarly to transmit RTTY. The CW byte is loaded into the A accumulator and the data bit is shifted into the carry and sensed as a transmit mark or space. The lower three bits in the CW transmit byte indicate the number of CW bits to be transmitted. Various delays are made in the software to proportion the relationship between the dot and dash.

The plus command loads three station buffers with characters. These buffers can be preloaded with messages and saved on tape with the program. Two of the station buffers have 254 bytes; the third has 125 bytes. This restriction was due primarily to the RAM limitations of a 4K computer. The buffer sizes and numbers can be changed to suit individual taste. You are limited only by the size of RAM in your computer. One feature of the load command is that RTTY is transmitted as the buffer is loaded.

The greater-than key is used to transmit station buffers which have been loaded previously.

The equal-to command is used to transmit a series of RYs to test out the equipment at both ends of the path.

Program Assembly and Saving

As discussed earlier, the program can be loaded directly into memory and saved as a binary file on tape by a machine-language monitor or from Extended Tandy Basic. The best way is to key the source into the computer using a text editor, then use an assembler to generate object code. This technique will allow for ease of modification at some later date. A good idea might be to load up the station buffers with text which you normally send on RTTY and save the complete text and program on tape.

If you wish to load this program on Tandy disk, it must be placed above address $0F00 and then saved on disk. The program can also be placed on EPROM. This will require a change to the program. The text buffers and the program RAM constants must be changed to a location in RAM and the program assembled at the ROM address. This is another advantage of using an assembler to create the object code. The program uses 1609 bytes of code, which means that it can fit on one 2716 EPROM. The program can then be placed in a ROM cartridge if assembled at location $C000. The RAM buffers could be placed at $0600 and loaded or saved from tape.

RTTY Interface

Almost any RTTY TU interface will function with this program. Numerous articles have been published in many magazines on this subject. The only requirement is that the input and output from the computer be through the RS-232 interface on the rear of the computer. All that is required is a 4-pin DIN connector, a cable, and a TU. The CoCo is quite tolerant; it will accept standard TTL voltage levels or RS-232 levels. A number of commercial firms produce interfaces which are advertised in this magazine. For some of you devoted home-brewers, see Fig. 1, a schematic of a simple RTTY interface which was provided to me by Dynamic Specialities.

RTTY Interface Circuit

The interface is quite straightforward and uses easy-to-obtain components. The interface can be constructed on perfboard or a pluggable prototype card and placed into a cabinet. On RTTY receive, the circuit uses two bandpass filters of 2125 and 2295 Hz respectively to filter the RTTY tones. The filtered tones are connected to a simple AFSK detector which consists of an XR2211 and some drivers which are connected to the RS-232 input of the CoCo.

A switch is provided on the buffer circuitry after the XR2211 demodulator. This switch is optional. Once the correct polarity of the signal is determined, the circuit can be hard-wired, thus eliminating the polarity switch.

The tuning meter on the output of the filters is required due to the sharp response of the filters used. When adjusted correctly, a mark tone will swing to 20 microamps and a space to 40 microamps. During normal RTTY reception, the meter will read 40 microamps.

To transmit RTTY, the interface uses an AFSK modulator. This modulator consists of a single XR2206 IC. This IC takes an output from the RS-232 interface on the CoCo and converts the voltage to an audio tone. This tone is either 2125 Hz (mark) or 2295 Hz (space). To adjust the AFSK generator, ground pin 9 of the XR2206 and, by use of a counter, adjust the output to 2125 Hz. Next, place 10 volts on pin 9 and adjust for 2295 Hz.

Next, connect the modulator output to the TU input and adjust the mark and space filters.

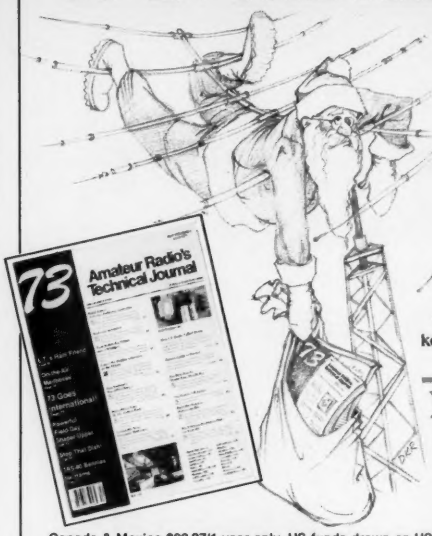
To connect the TU to a ham transceiver is a simple process. Connect the transceiver's headphone output to the TU's input. Connect the AFSK output to the microphone of the transceiver. Switch the transceiver to lower sideband. Presto, you are now on RTTY.

Conclusion

The RTTY program described in this article was a lot of fun to develop. Its performance leaves a lot to be desired in features and usability. A very desirable function is split-screening of the buffers and receive data. This feature is very tricky to program and requires the use of interrupts. If you are interested in more advanced RTTY, SSTV, WEFAX, or CW amateur radio software, drop me a line for information on its availability.

I would like to thank Dynamic Specialties for providing the TU circuit. An advanced version of the TU is available in PC board form and includes a state-of-the-art automatic digital filter. Contact Dynamic Specialties, PO Box 20903, San Jose CA 95160, for more information.■

UP IN THE AIR ABOUT A CHRISTMAS GIFT FOR YOUR HAM?



Come down to Earth . . . give a gift subscription to 73: Amateur Radio's Technical Journal. Every issue is filled with practical information. Now your favorite ham can:

• have hours of fun in the shack with over 200 construction projects per year. • keep abreast of the latest developments in amateur radio around the world with the monthly column, "73 International". • save money through our candid reviews and new-product announcements.

Christmas shopping has never been easier. Just fill out the coupon and return it to: 73 Subscription Department, P.O. Box 931, Farmingdale NY 11737. It's only $19.97 for a full-year subscription. That's a savings of 33% off the newsstand price.

This year, avoid the holiday crowds and pushy salesmen. Give your ham the gift that will keep him happy on the air . . . 73 Amateur Radio's Technical Journal.

YES! I'll give a useful gift. Send 12 issues of 73: Amateur Radio's Technical Journal for only $19.97 to the person I've named below:

☐ MC ☐ VISA ☐ AE ☐ CHECK/MO ☐ BILL ME

CARD #_____ EXP. DATE_____

SIGNATURE _____

MY NAME _____

ADDRESS _____

CITY_____STATE_____ZIP_____

Send the subscription to:

NAME _____

ADDRESS _____

CITY_____STATE_____ZIP_____

Canada & Mexico $22.97/1 year only, US funds drawn on US bank. Foreign surface $39.97/1 year only, US funds drawn on US bank. Foreign air mail please inquire. All gift subscriptions begin with the January 1984 issue.

73® Amateur Radio's Technical Journal
P.O. Box 931
Farmingdale, NY 11737 639R6

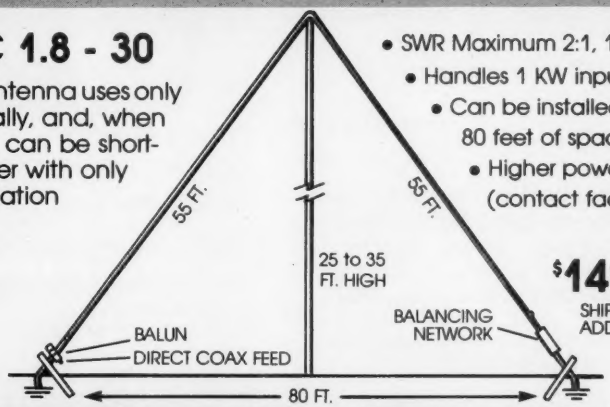
NEW from BARKER & WILLIAMSON!

1.8 - 30 MHz. Continuous Coverage Antenna for Commercial and Amateur Service

Model AC 1.8 - 30

The AC 1.8 - 30 Antenna uses only 80 feet horizontally, and, when space is limited, can be shortened even further with only slight loss of radiation efficiency.

Patent Pending



- SWR Maximum 2:1, 1.4:1 Average
- Handles 1 KW input ICAS
- Can be installed in approximately 80 feet of space
- Higher power models available (contact factory)

$149.50
SHIPPING AND HANDLING ADD $4.00

B&W **BARKER & WILLIAMSON** ALL OUR PRODUCTS MADE IN USA
Quality Communication Products Since 1932
At your Distributors write or call, 10 Canal Street, Bristol PA 19007
(215) 788-5581 -11

See List of Advertisers on page 114

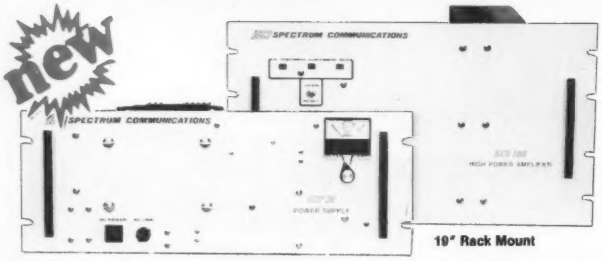
Now's The Time To Buy That New Repeater!

To Replace "The Old Klunker" For That "New System" you've been Thinking about

Spectrum's Got-

- **The widest line of Repeater/Link Equipment**
- **The Highest Performance—by far!**
- **The Finest Quality**

SCR77 Basic Repeater/link Xcvr.



19" Rack Mount

SCA100W UHF.AMP w/companion SCP30 30A Power Supply.
Both Super Heavy Duty!

Also 150W VHF.

SCR 4000 Super Deluxe Repeater w/Optional Cabinet & Accessories

There's never been a better time to buy a Spectrum Repeater or Link Equipment. Deliveries are the fastest ever—4-5 wks. as of this writing, with some models in stock. And, with the introduction of our New 100W Repeater Amp/Pwr. Supply Package and UHF Rcvr. Helical Resonator Front End Assembly, we have the best performing, most complete line available!

Go With The Leader! Call or write today for a brochure & prices. Sold Factory Direct or through Export Sales Reps.

AVAILABLE WITH

- ☐ Autopatch, w/Reverse Patch & Land Line Control
- ☐ Touch Tone Remote Control Functions
- ☐ Various Tone & Timer Units
- ☐ "Emergency Power ID"
- ☐ Duplexers, Cabinets, Antennas, etc. for a complete system

F.C.C. TYPE ACCEPTED FOR COMMERCIAL SERVICES

SPECTRUM
Export Orders Welcomed

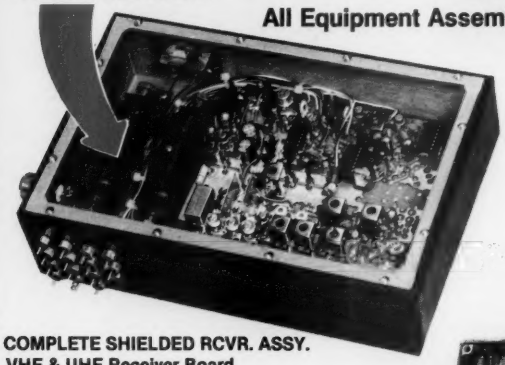
1055 W. GERMANTOWN PK., DEPT S9

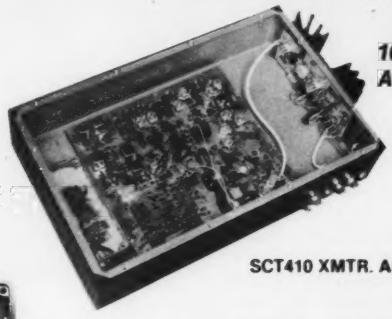
Spectrum Repeater Boards & Sub-Assemblies

New FL-4 UHF Helical Resonators

These are professional "Commercial Grade" Units—Designed for Extreme Environments (−30 to 60° C.)

All Equipment Assembled & Tested. For 10M, 2M, 220 MHz, & 450 MHz





10M ALSO AVAILABLE

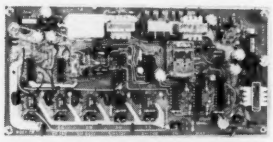
SCT410 XMTR. ASSY.

COMPLETE SHIELDED RCVR. ASSY.
VHF & UHF Receiver Board
SCR 200-VHF SCR 450 UHF

- ***Totally Advanced Design!***
- 8 Pole Front End Fltr. + wide dynamic range—reduces overload, spurious Resp. & IMs!
- Sens. 0.3 uV/12dB SINAD typ.
- Sel. -6dB @ ± 6.5 KHz. -130dB @ ±30KHz. (8 Pole Crystal + 4 Pole Ceramic Fltrs.
- 'S Meter,' Discriminator & Deviation Mtr. Outputs!
- Exc. audio quality! Fast squelch! w/0.0005% Crystal. *("Super Sharp" IF Fltr. also avail.)*

Complete Receiver Assemblies

- **Rcvr. Bd. mounted in shielded housing.**
- Completely asmbld & tested, w/F.T. caps, SO239 conn.
- As used in the SCR1000. Ready to drop into your system!
- UHF Rcvr. Assy. Now Available w/Super Sharp FL-4 Helical Resonators. Greatly reduces IM & "out of band" Interference!



SCAP Autopatch Board

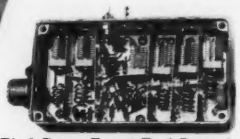
- Provides all basic autopatch functions
- Secure 3 Digit Access; 1 Aux On-Off function, Audio AGC; Built-in timers; etc. Beautiful Audio!
- 0/1 inhibit bd. also available
- Write/call for details and a data sheet

RPCM Board

- Used w/SCAP board to provide "Reverse Patch" and Land-Line Control of Repeater
- Includes land line "answering" circuitry

Lightning Arrester For SCAP

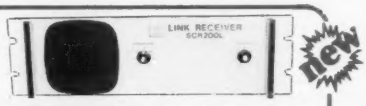
- Gas Discharge Tube shunts phone line surges to ground
- Handles up to 20,000 Amps!
- The Best device available to protect Autopatch equipment from lightning damage. $14.00 + S/H.



FL-6

FL-6 Rcvr. Front-End Preselector

- 6 Hi Q Resonators with Lo-Noise Transistor Amp (2M or 220 MHz).
- **Provides tremendous rejection of "out-of-band" signals w/out the usual loss!** Can often be used instead of large expensive cavity filters
- Extremely helpful at sites with many nearby VHF transmitters to "filter-out" these 'out-of-band' signals



VHF/UHF LINK CONTROL RCVR.
Complete Shielded RX Assy.
With 19" Rack Mount.

CTC100 Rptr. COR Timer/Control Bd.

- Complete solid state control for rptr. COR, "Hang" Timer, "Time-Out" Timer, TX Shutdown/Reset, etc.
- Includes Inputs & Outputs for panel controls & lamps

TMR-1 "Kerchunker Killer" or "Time Out Warning Tone" Bd.

Repeater Tone & Control Bds.—For SCR1000/4000 & CTC100/D250 only
TRA-1 "Courtesy Tone Beeper" Board

PRM200 Power Supply Filter Cap/Regulator/Metering Board

- As used in the SCR1000 as main part of 13.8VDC/8A Pwr. Sply.

PSM-1 Repeater Power Supply Mod Kit

- For SCR1000 or ACR4000. Replaces Darlington Pass Tr. for improved reliability.

SCT110 VHF Xmtr/Exciter Board

- 10 Wts. Output. 100% Duty Cycle!
- Infinite VSWR proof.
- True FM for exc. audio quality.
- Designed specifically for continuous rptr service. Very low in "white noise."
- Spurious -70 dB. Harmonics -60 dB
- With .0005% xtal.
- **BA-10 30 Wt. Amp board & Heat Sink,** 3 sec. L.P. Filter & rel. pwr. sensor. **BA75 75 Wt. unit also available.**

SCT110 Transmitter Assembly

SCT110 mounted in shielded housing.
Same as used on SCR1000.

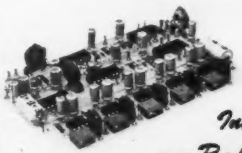
- Completely assmbld. w/F.T. caps, SO239 conn.
- 10, 30, or 75 Wt. unit.

SCT 410A UHF Transmitter Bd. or Assy.

- Similar to SCT110, 10 Wts. nom.
- ✱ ***Now includes "on board" proportional Xtal Osc./Oven circuitry for very high stability!***
- **BA-40 40W. UHF AMP. BD. & HEAT SINK.**

PCB-1 Xmtr. Power Control Board

- For SCT110 or SCT410 Exciters
- Varies B + to control Pwr. Out
- Switchable Hi, Low, or Med. Pwr. out, locally or remotely. Adj. levels.



TTC 100
Touch Tone
Control Board

Interface to any Radio or AF system!

- 3 digit ON, 3 digit OFF control of a single repeater function, or (optional) 2 functions (2 digits ON/OFF each).
- Can be used to pull in a relay, trigger logic, etc.
- Typically used for Rptr., ON/OFF, HI/LO Pwr PL ON/OFF, Patch Inhibit/Reset, etc.
- Stable anti-falsing design 5s limit on access
- For add'l function(s), add a *"Partial TTC"* board

COMMUNICATIONS CORP.

INQUIRE ABOUT 'SURPLUS' RX & TX BOARDS. REDUCED PRICE! ✓68

Norristown, PA 19401 ● (215) 631-1710

73 INTERNATIONAL

Each month, 73 brings you amateur radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Avery L. Jenkins WB8JLG.*

BANGLADESH

M. Saifud Dahar Shahid
President, BARL
GPO Box 3512
Dacca, Bangladesh

BARL ADMITTED TO IARU

The Bangladesh Amateur Radio League (BARL) applied for membership in the International Amateur Radio Union some time back. In a special issue of *IARU Calendar* (no. 108, December 8, 1981), the headquarters made a proposal concerning the admission of BARL. *Calendar* no. 111 (March 24, 1982) published the results of the election of BARL.

It is very encouraging to note that all of the 49 votes received by the IARU headquarters were in favor of BARL admission. Bangladesh is the 115th member society of this international body.

BARL JOINS IARU REGION 3 ASSOCIATION

After joining the IARU, BARL applied for membership in the IARU Region 3 Association. In the Fifth Conference of the Region 3 Association, held in Manila, Philippines, this application was considered. BARL has now been officially informed by the Region 3 Association that it has been accepted as the 18th member of the Associaton.

IARU VP VISITS DHAKA

Carl L. Smith W0BWJ and his XYL, Terry, visited Dhaka recently. In his report, the IARU vice president mentioned that "a continued organizational development of the BARL was noted in Bangladesh."

This is the second time an IARU officer visited Bangladesh. In 1981, BARL had a visit from David Rankin, then-secretary and present chairman of the Region 3 Association. During his visit, David met with the high officials of the T&T Board and the Wireless board, the Minister for PT&T, the State Minister for Science and Technology, and the Prime Minister. A TV interview of David was also recorded for broadcast on April 26, 1981.

These visits certainly contributed to the promotion of amateur radio activities in Bangladesh.

BARL PRESIDENT VISITS USA AND SRI LANKA

BARL President Saif Shahid, during his visit to the USA in April, 1982, made contacts at the IARU headquarters at the ARRL. He spoke with Victor C. Clark W4KFC and David Sumner K1ZZ about the development of amateur radio in Bangladesh.

On a separate visit, Saif Shahid and Tariq Hasan, another member of BARL, visited Sri Lanka to attend a two-week-long seminar on microcomputers. During their stay they were invited by John Amaratunga 4S7JA (RSSL president) to a dinner followed by a visit to 4S7EA's shack for a demonstration of a RTTY QSO on a VDU. BARL looks forward to a long-lasting friendship with RSSL.

BARL APPLIES FOR CLUB STATION LICENSE

BARL has applied to the Wireless and Frequency Allocation Board for issuance of an ad hoc amateur radio license for a BARL headquarters club station. It is understood that the application is under active consideration by various government agencies. BARL expects to have the club license in time to enable it to participate in various activities during World Communications Year.

In the second Bangladesh Electronics Symposium, a paper titled "Role of Amateur Radio in Bangladesh" was presented jointly by Saif Shahid and Nizam Chowdhury. The technical session was chaired by Air Vice Marshal Sultan Mahmood, Chief of Air Force Staff. The paper highlighted the various aspects of amateur activities and the prospects of such activities in the technical advancement of a developing country like Bangladesh.

CANADA

Cary Honeywell VE3ARS
PO Box 2610, Station D
Ottawa, Ontario K1P 5W7

By the time most of you read this, the summer will be gone. In some places in Canada the summer is measured in days rather than months. This does not stop clubs and organizations from holding their annual flea markets and hamfests. Most of ours cannot match the Dayton or Rochester hamfests, but for Canada, they come close.

In the eastern part of the country, the big ones are held near the Toronto, Ontario, area: The Whitby area holds one in late April or early May, while Guelph holds theirs in the first week of June. July sees the Southern Ontario Hamfest, held at Milton, just west of Toronto. One of the biggest hamfests in Canada is the RSO convention, held each fall. This year, Toronto hosts this event.

In the contest area, the CARF-sponsored Canada Day Contest was held on July 1, this being Canada's birthday. Although not as well advertised this year, the event made most bands very active with Canadian stations.

In my August column, I was discussing TRC24, the syllabus for amateur examinations, and how the efforts of the amateur community were wasted. Well, it seems the DOC heard our cries of anguish. Shortly after a meeting between CARF officials and the Director General of Telecommunications for the DOC, both CARF and the Canadian Division of the ARRL were asked to submit proposals to amend the issue. CARF President Don Slater VE3BID and ARRL Canadian Director Tom Atkins VE3CDM agreed on a method of obtaining a consensus before the June 10th deadline which the DOC had specified. The cooperation between the two groups was well under way when the Canadian vice director Harry MacLean VE3GRO, intervened and asked for the DOC to extend the deadline. So much for cooperation. The matter is still up in the air, and I will let you know how things develop.

On other matters, the Canadian Amateur Radio Federation held its Annual General Meeting during May. At the meeting, two new directors were introduced: Robert Sondack VE2ASL of St. Luc, Quebec, well known in AMSAT circles in that province and also a director of the Quebec provincial amateur association, RAQI; and Leigh Hawkes VE1ZN of Dartmouth, Nova Scotia. Leigh is also well known in Canada as one of the most prominent workers on cable television interference. These gentlemen join Craig Howey VE3HWN of Waterloo, Ontario; Geoff Smith VE3KCE of Aurora, Ontario; Norm Waltho VE5AE of Moose Jaw, Saskatchewan; and Peter Driessen VE7AB of Surrey BC in the job of directing Canadian amateur affairs for the federation. Two departing directors, Nate Penny VO1NP of Shoal Harbour, Newfoundland, and Raymond Mercure VE2BIE of Hull, Quebec, were congratulated on a job well done and wished good luck. All other positions in the federation remain the same.

I would like to hand out a couple of laurels this month. First, to Bill Deacon VE3BDO. Bill has been writing a superb series of articles called "Life on the Ocean Wave" for *TCA* over the past few months. A steady stream of letters has been coming in to the editor of *TCA* (me) in support of this assessment. The Society of Wireless Pioneers is preparing to reprint the series soon, and I hope more of you will get the chance to read these memoirs of a radio operator in the pre-WWII era of radio.

My second laurel goes down east. Across Canada, we have many QSL bureaus, both outgoing and incoming. The best known outgoing bureau is the CARF National QSL bureau at Box 66, Islington, Ontario. The best known incoming bureau is in Halifax, Nova Scotia, and is run by Britt Fader VE1FQ. For many years the Canadian Division ARRL's central bureau was run by Britt and even though his is only a provincial operation now, he still receives and forwards many QSL cards. A tip of the hat to Britt Fader VE1FQ.

By the way, if you are wondering why the CARF QSL bureau is not in the *Callbook*, the answer is simple. It is not the ARRL bureau.

BRAZIL

Gerson Rissin PY1APS
PO Box 12178, Copacabana
20000 Rio de Janeiro, RJ
Brazil

BRAZIL WINS ITU TROPHY

The ITU Contest is sponsored every second and third weekend of May to commemorate the World Telecommunications Day (May 17th). The ITU Trophy goes to the country with the highest aggregate score. (Brazil's total was 442,825.) This is determined by the top five single-operator scores plus the top multi-operator scores, both on phone and CW. The trophy remains in the possession of the representative national association of that country for one year. It is retired by the country winning three consecutive times or five intercalated times. (See box for scores.)

Other trophies won were as follows. Single operator: Gold—RX7CF for CW and UP2NK for phone; Silver—PY1DOQ for CW and OE3ITU (OE2VEL) for phone; Bronze—EA2IA for CW and HA5WE/7 for phone; and Silver Plates for multi-operators LZ1KDP for CW (257,096 points) and UK0QAA for Phone (364,984 points).

WORKED ALL PP AWARD

Sponsored by LABRE/Goias, the WAPP

1982 ITU CONTEST RESULTS

Single Operator (All Bands)		Multi-Operator (All Bands)	
CW	**Points**	**CW**	**Points**
RX7CF	234,419	LZ1KDP	257,096
PY1DOQ	193,104	UK2PRC	185,702
EA2IA	168,760	UK2PCR	142,120
UP2BAO	97,779	UK2BBB	126,936
UA6LLT	94,146	RK7PAL	69,444
EX5UKW	88,910	UK2BCR	61,848
ON6TW	81,039	UK4WAB	42,600
IO2DMK	76,938	HA9KSF	31,671
F6DKV	57,150	UK5AAA	31,125
PR7CM	37,520	HA8KAX	23,232
Phone	**Points**	**Phone**	**Points**
UP2NK	268,919	UK0QAA	364,984
OE3ITU	224,964	UK2PRC	209,150
HA5WE/7	126,174	LZ1KDP	200,658
PP2ZDD	121,088	UK2BBK	120,460
DL7RT	96,320	LX0RL	71,307
Y35TE	36,150	UK5IAZ	47,928
ZY1NEZ	31,185	YO3KWJ	2,568
YB8VB	26,892	JA1ZGP	552
DA2QS	23,652	VK2ATZ	497
LZ2AF	23,163		

SWL

CW	Phone
OK2-9329—Dusan Hanak	AP-0101—Farrukh Zia

At Last.

A microthin, synthesized, programmable, sub-audible tone encoder that fits inside the ICOM IC-2AT.

Need we say more?

$29.95

COMMUNICATIONS SPECIALISTS 15

426 West Taft Avenue, Orange, CA 92667
800/854-0547 California: 714/998-3021

Award is available to all licensed amateurs for confirmed contacts with : (a) PY1 staprefixes (PP1, PP2, PP5, PP6, PP7, and PP8). The PP2 contact must be with a station located in the city of Goiania. The award is to celebrate the centennial of the city of Goiania, in Goias State.

All contacts must be made during 1983, on any band and any mode. Send GCR log of stations worked (call, date, time, band, mode, and report) and 10 IRCs for mailing expenses, to LABRE/Goias—Coordenador De Diplomas, PO Box 676, 74000 Goiania, GO, Brazil.

There are no special endorsements for the WAPP Award.

SWL: Same rules.

CWRL AWARD

Sponsored by the Lakes Region of the Rio de Janeiro Radio Club, the CWRL Award is available to all licensed amateur for confirmed contacts with: (a) PY1 stations whose first suffix letters form the phrase: *Araruama—onde o sol passa o inverno* (meaning: "Araruama—where the sun spends the winter), and (b) three CWRL members (any prefix or suffix).

Contacts must have been made after January 1, 1983, on any amateur band. Only two-way CW mode.

Send GCR log of stations worked (call, date, time, band, mode, and report) and 10 IRCs for mailing expenses, to CWRL Bureau, PO Box 91, 28970 Araruama, RJ, Brazil.

There are no special endorsements for the CWRL Award.

SWL: Same rules.

CWRL members are PY1AEE, PY1AFA, PY1ASI, PY1AZG, PY1BPI, PY1BUG, PY1BVY, PY1CC, PY1COA, PY1DEA, PY1DFF, PY1DGB, PY1DJY, PY1DMQ, PY1DMX, PY1DPG, PY1DQV, PY1DWM, PY1EBH, PY1EBK, PY1ECL, PY1EWN, PY1GO, PY1TCJ, PY1TZ, PY1VMW, PY1VEH, PY1VTN.

COLOMBIA

Abelardo (Lalo) Santos V. HK3EQJ
PO Box 88937
Bogota
Colombia

MALPELO (HK0TU) DXPEDITION

In the second week of October, 1983, for five days, there will be a DXpedition to Colombia's Malpelo Island, located at 3° 59' 07" latitude north, 81° 34' 27" longitude west, in the Colombian Pacific Ocean territorial waters. The DXpedition is jointly sponsored by the Colombian Radio Amateur League (Liga Colombiana de Radioaficionados) in cooperation with the Colombian navy, which will supply the transportation and the required logistics support.

The main goal of this extremely interesting DXpedition (Malpelo Island being the fourth most important valid country for the DXCC award) is to publicize Colombian radio amateur operations. This year the Liga Colombiana de Radioaficionados is celebrating its 50th anniversary.

Because of the roughness of the terrain, the DXpedition organizers required all participants to have perfect health, good physical fitness, and, if possible, previous experience in this kind of DXpedition. They also have to be younger than 46. However, as is well known, some of the "oldies" are tougher and better performers in the field. A main team of 15 Colombian operators is being carefully selected by the League.

The transmitting frequencies are: CW—28,025; 21,025; 14,025; 7,025; 3,525; and 1,825 kHz; phone—28,595; 21,295; 14,195; 7,085; 3,795; and 1,825 kHz. Also, there will be extensive experimentation via satellite on 146.460 MHz. The QSL manager will be internationally famous Beto Rojas HK3DDD.

Though an inscription limit was locally set till the end of May, 1983, written applications from foreigners (on a restricted basis) are welcomed by the League via PO Box 584, Bogota, Colombia, South America.

FRANCE

Claude Guee F1DGY
11 Rue Emile Labiche
28100 Dreux, France

TERRES AUSTRALES FRANCAISES AWARD

For three contacts with these different lands, or four contacts to receive the golden star "EXCELLENCE" award: FB8FX (Kerguelen Island), FB8Z (St. Paul, Nouvelle Amsterdam Island), FB8W (Crozet Island), and FB8Y (Terre Adelie).

Only contacts after April 1, 1946, are valid. The fee is 10 IRCs.

DEPARTMENT ET TERRITOIRES D'OUTRE-MER AWARD

For contacts with these nine different prefixes: FM7 (Martinique), FG7 (Guadeloupe—St. Martin, St. Barthelemy), FY (Guyane), FR (Reunion—Glorieuse, Europa, Tromelin, Juan de Nova), FP (St. Pierre et Miquelon), FK (Nouvelle Caledonie—Pins, Chesterfield, Huon, Loyautes), FH (Comores), FW (Wallis-Futuna) and FO (French Polynesia).

Only contacts after January 1, 1982, are valid. The fee is 10 IRCs. For these two awards, the manager is Alain Duchauchoy F6BFH, 21 Rue de la Republique, 76420 Bihorel, France. The usual conditions apply to these awards (certified log extract, no QSL requirement).

OTHER NEWS

At this moment, there are about 12,000 French radio amateurs. Despite the fact that France was once very advanced in this hobby, this one is not as popular as it should be! Especially if we compare ourselves with other countries.

Besides the conventional traffic on the HF bands, the upper bands are more and more used as follows:

- 2 meters with repeaters mainly, but also SSB, satellites, RTTY, SSTV, and CW.
- 70 cm with repeaters also (many promising projects), fast scan TV, SSB.
- 23 cm—the new frontier—some repeaters are scheduled. Currently, most activity is on FM, SSB, and fast-scan TV. Aerials are generally F9FT 23-element beams.
- 10 GHz—This band had its heyday some years ago with Gunn diodes. Nevertheless, fans are numerous and there are regular skeds on FM, SSB (fast-scan TV also).
- Otherwise, microcomputing is now a very active branch for hams. Many radio clubs are the first school for newcomers.
- Two associations help the French ham. They publish two magazines: Reseau des Emetteurs Francais (REF) publishes *Radio REF*, and the Union des Radio-Clubs (URC) publishes *Ondes Courtes Informations*.

CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol, Cyprus

AN OVERVIEW: AMATEUR RADIO IN CYPRUS

At the present there are about 280 amateur radio licenses with the 5B4 prefix and a dozen or so with the ZC4 one. The 5B4 licenses are issued by the Republic of Cyprus and the ZC4 by the British bases' authorities in Cyprus.

Although someone would expect that this number of amateurs is high compared with the 630,000 population of the island, not many amateurs are active on the HF bands. All amateur radio acitvity comes from the southern part of the island, which is under the control of the government of the Republic of Cyprus, and the great majority of amateurs are Greek Cypriots. On the northern part of the island, which is under Turkish occupation, there is no amateur activity at the moment. Occasionally there is some activity there by United Nations personnel operating with a 5B4 license.

There is only one type of license which permits use of all bands and modes. Licensing conditions and restrictions are very similar to the old British regulations—Cyprus being an ex-British colony. On the HF bands, only about a dozen stations are active at the moment, mostly on 20m, 15m, and 10m. The rest of the stations are either not active at all—some do not even own equipment—or operate on 2m only.

To help amateurs without equipment as well as prospective amateurs, who are usually young boys, a few keen amateurs have established one club station in each city. These stations are active once a week for only a few hours. These clubs also offer instruction by suitably qualified amateurs to help prospective amateurs pass the radio amateur examinations. The tests are given by the Ministry of Communications and Works, but the British Radio Amateurs Examination is also accepted.

Most 5B4 stations are on SSB 20m, 15m, and 10m, but one or two of them can be found on 75m and 40m. On the last two bands, 5B4EP and 5B4JE are still active. During the winter, 5B4EP, 5B4JE, and 5B4PW occasionally operated on 160m.

As far as I know, only about four 5B4 stations are using CW at the moment and perhaps an equal number of ZC4s. On RTTY, only two stations are active, 5B4CV and 5B4HF, mostly on 20m. During the last few months, 5B4CV also was active on SSTV, and after a short break he will soon be operational again with a home-brew camera.

Most of the equipment used by Cyprus amateurs is commercial and imported, but there also is some home-brewing going on, such as tuners, linear amplifiers, small transceivers, test gear, antennas, etc. Leaders in home construction at the moment are 5B4BS, 5B4CV, 5B4AZ, 5B4AH, and 5B4DV.

The Cyprus Amateur Radio Society (CARS), a member of the IARU, besides other activities runs a QSL bureau which is very conscientious but also very slow, through no fault of its own. The reason is purely economic. The QSL manager has to wait a long time to collect enough cards for a certain country so that postage will be cheaper. CARS is not so strong financially because not all licensees are members of CARS. My advice for amateurs, if they want to get a quick QSL card, is to QSL direct. Using the bureau takes as long as three years sometimes.

I do hope that I have given you a general idea about amateur radio in Cyprus. In future columns, I will give you information about awards, temporary licenses, and current 5B4 activities.

From Cyprus, the island of Aphrodite, goddess of love, we hope to keep you informed regularly.

Aris 5B4JE.

GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire, England

THE UK SCENE

For as long as I have been reading *Radio Communication*, the monthly journal of the Radio Society of Great Britain (known to everyone as *Radcom*), there has been a monthly column called "Technical Topics." This 3-to-6-page potpourri (known throughout G-land as "TT") has provided a forum for new, sometimes untried, ideas. It reports on the proceedings of appropriate learned bodies such as the IEEE, it summarizes foreign amateur radio journals including those written in non-

Grab a fistful of TEN-TEC's new 2 meter FM talkie

it has features never before available in one handheld, it's made in the USA and it's priced right!

COMPARE TENNESSEE TECHNOLOGY WITH THE OTHERS...

Do their handhelds have memory lockout?
Exclusive memory lockout on the TEN-TEC 2591 allows scanner to temporarily bypass channels for quick lockout of busy frequencies yet retain them in memory for normal operation on demand.

Do theirs store transmit offset?
The 10 memories of the 2591 allow stored offset for easiest operation. And memory channel 0 accepts any non-standard offset.

Do theirs offer selectable SKIP or HOLD?
When scanning with the 2591, choose HOLD to stop and stay on a busy frequency. Choose SKIP to stop for several seconds and continue.

Do theirs offer modifiable Band Scan without complete reprogramming?
With the 2591 you can scan any section of the band with user defined upper and lower limits in steps of 5, 10, 15, 25, or 30 kHz. Change step size, upper and lower limits independently. Manual Scan also, up or down, in 5 kHz steps.

Do theirs have Quick-Release NI-CAD Battery Pack?
The 2591 battery pack slides off easily, yet is secure in use, has a heavy duty 450 mAH rating at 8.4v, and the 2591 has capacitive memory retention to permit pack changing without reprogramming.

THE TEN-TEC 2591 HAS ALL THE RIGHT FEATURES...

• **Memory Scanner scans only programmed channels** and has user selectable HOLD or SKIP • **Selectable 2.5 Watts or 300 Milliwatts power,** top panel switched • **Extended Frequency Coverage—143.5 to 148.995 MHz.** Covers full Amateur Band plus some CAP and MARS frequencies. • **4-Digit LCD Readout with Switchable Back Light** —large, easy-to-read digits, selectable for frequency or memory channel number. • **Key-Pad Frequency and Function Control** —16 key dual tone encoder • **Dual Function LED**—shows battery status and transmit mode. • **Electret Microphone** plus separate speaker for superior audio. • **Compact, Lightweight, Complete**—easy to handle and rugged. Standard equipment includes flexible antenna with BNC connector, AC charger, belt clip, connectors for mike and speaker. Options include: adaptor pack for +12 VDC mobile operation, speaker/mike, 25 watt power amplifier, leather case, desk charger, subaudible tone module, and spare NI-CAD pack.

TEN-TEC

DESIGNED AND MANUFACTURED IN TENNESSEE and it carries the famous TEN-TEC 1 year warranty. See your dealer for the best in 2 meter FM—the TEN-TEC 2591. Or write for information to TEN-TEC, Inc., Sevierville, TN 37862.

English languages, and it suggests new circuit ideas.

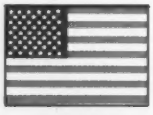
A recent TT in *Radcom* included the following variety of subjects:

- Electro-Magnetic Compatibility (EMC) and its supplanting of RFI and TVI as the main external factor affecting the operation of amateur stations.
- Screening and filtering and the need to minimize out-of-band or unnecessary in-band radiation at source. The work done by Philip Rand W1DBM many years ago was discussed again.
- A 20-A power supply following the KISS (Keep it Simple, Stupid) principle and using only 17 components. The originator of the circuit, G4HYD, counsels the underrating of components in such systems.
- High-power MOSFET amplifiers as originally presented by K7ES/OH2ZE in *QST*.
- New loop antennas raised again the thorny problem of defining HF antenna performance. Systems such as the G2PL special (turned-over quad) seem to indicate that a horizontal loop antenna can provide effective low-angle, DX-working even when the wire is only a few feet above ground. However, TT also promulgates the theories that (a) it would be impossible to devise any piece of wire that would never result in DX when conditions were very good, and (b) when an amateur puts up a new antenna he tends to become more active and this results in more and better DX until at least the first flush of enthusiasm wears off.

All very interesting and thought-provoking stuff—but why report the contents of an average TT in "The UK Scene?" The edition to which I refer is remarkable for two reasons. First, it is twenty-five years since the column started and any silver jubilee is worth celebrating (as any readers lucky enough to be in the UK in 1977 will testify). Second, TT has been written for all those 25 years by the same author, Pat Hawker G3VA. Quite an achievement, I think, to cover virtually the entire era of silicon and the parallel demise of thermionics without becoming boring or repetitive.

It seems that there may have been some substitution of candidates for the Home Office Morse test in recent months. (Passing the test at 12-wpm send and receive is a prerequisite of a full HF-class A license.) The authorities have "with some reluctance" introduced new vetting procedures for prospective amateurs sitting the test. It is now necessary for some positive means of identification such as a passport to be produced. Presumably, a document bearing a photograph will be necessary.

The Morse test is carried out by the Maritime Branch of British Telecom (formally the Post Office) at a coastal radio station. Although informal in nature, the required standards have not been allowed to slip. Taking the test currently costs US$22 and may involve quite an amount of traveling, as many BT coastal radio stations are now unmanned and operated remotely.



GUAM

J. T. Pogue KH2AR
68 Banyan Circle
FPO San Francisco 96630

THE VIEW FROM GUAM

Many hams around the world are familiar with the two dots on our globe that share the name Cocos Island. The first, off Costa Rica's western shores, sports the TI9 callsign prefix. The other

OM J. A. Faithful VU2JA.

Cocos Island (also known as Keeling Island) is located in the eastern Indian Ocean, and hams operating from there use the VK9Y prefix.

Here on Guam, however, we have our own Cocos Island. Located just over two miles from Guam's southernmost village of Merizo, the narrow sliver of land points like a finger extending into the crystal blue waters of the Philippine Sea.

Shortly after WWII, the US Coast Guard built a LORAN "A" station on the island. However, with the advent of the LORAN "C" system, the Cocos station was closed and much of the island was turned over to enterprising developers. Today, a beautiful beach, a picnic area, a small zoo, and plans for a resort hotel with casino make Cocos Island a popular destination for tourists and residents alike.

Recognizing this popularity, the Guam chapter of the American Red Cross has, since 1981, held an annual fund-raising event called the Cocos Challenge. The object of the challenge is to swim, snorkel, sail, paddle, or in some other way travel the distance from Cocos to Merizo. And, for the third consecutive year, the Red Cross requested assistance from Guam's hams to help ensure the safety of the participants. Thus, at 6:00 am on May 15th, 10 hams from around the island met with their 2-meter gear to help make the third annual Cocos Challenge a little safer for those in the water.

Preston "Al" Allen KH2BB acted as net control at the officials' tent, while Dave Beck KH2BD kept an eye on things at the Merizo Pier finish line and Ann McDaniel KG6JKN helped out at the starting line on Cocos. The remaining operators, Bill Michling KH6IL, Russ Albee WB7EHU, Gerry McDaniel KG6JHN, Carl Wegner KG6JKV, Dave Chartier W1YRM, Gary Resta N2BMV, and Jim Pogue KH2AR took their places in the station. Rescue and Coast Guard boats were present to provide timely and reliable communications throughout the event.

Although no serious problems arose during the race, a few swimmers who tired early were pulled from the water and transported to shore.

Perhaps the highlight of the day was when one of the "Crazy Craft," an old VW car floating on pontoons, proved to be too unwieldy to make the entire trip to Merizo. The Coast Guard boat on the scene was heard reporting to their Rescue Center, "...be advised, we are headed for Cocos Island with a 1967 Volkswagen in tow." After a lengthy pause, the Rescue Center haltingly replied, "...say again?"

Al KH2BB operates net control during the 3rd Annual Cocos challenge.

INDIA

MEET JOE FAITHFUL VU2JA

There are a few valid reasons why we want you all to meet OM Joe Faithful VU2JA. He is one of the few hams who had the luck and opportunity to communicate with spark transmitters, carborundum crystal detectors, valve transmitters and receivers, and solid-state devices.

His vital statistics are: name—Joseph Alexander Faithful; born—April 11, 1898, in Shillong, India; callsigns—VU1AA, VS8AA, VU2BX, VU7AA, MP4BAF, and VU2JA; qualifications—PMG certificate—First Class for spark transmitter up to 5 kW (1920).

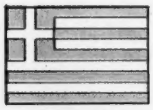
His awards and certificates:

1. The Old Old-Timers Club.
2. The Incorporated Radio Society of Great Britain, Corporate Member (1932) VU1AA.
3. The Incorporated Radio Society of Great Britain, WBE (1935) VU2BX.
4. All Asian DX Contest, 1940.
5. The Old Old-Timers Club, world's first OOTC 200 Award.
6. ARRL Old-Timers Club, 1958.
7. A-1 Operator's Club, 1961.
8. ARRL DX Century Club, 1962.
9. WAC/YL Young Ladies Radio League, 1966.
10. The OOTC QSO Party, first place in the continent of Asia (VU2JA, 1969).
11. WAS–CW, 1975.

On his way to England from India in 1914 (16 years old), he was taken as a prisoner of war during World War I. He escaped from the German POW camp in 1919 and reached England.

Can you beat this record?

At the young age of 85, Joe Faithful still feels like climbing up on the roof to experiment with different antennas—also, you can see the array of equipment still functioning faithfully. Joe is regular and active on all HF bands 80 through 10 meters between 0130 GMT to 1530 GMT depending on band condition. You can reach him at the following address if you want a direct sked or communication: J. A. Faithful, "Mon Desir," 20, Cubbon Road, Bangalore 560 001, India.



GREECE

Manos Darkadakis SV1IW
Box 3751
Athens, Greece

After a short review of Greek amateur radio history in my July column, we are now going to talk a little about the amateur community itself.

Today, the Amateur Radio Association of Greece has about 1,000 members; of course, not all of them are licensed to transmit. Licensed members number about 500. This number increases at the rate of at least 50 amateurs annually, after the two examination periods in March and September.

Not too long ago, Greece changed the callsign system that was in use for many years, which had only the number 1 after the SV prefix. We adopted the multi-number system common to most countries around the world. Therefore, Greece was divided into nine regions, and the SV0 prefix was assigned to foreigners operating

MIRAGE

American made RF Amplifiers and Watt/SWR Meters of exceptional value and performance.

•5 year warranty • prompt U.S. service and assistance

RF AMPLIFIERS

2 METERS-ALL MODE

B23 2W in=30W out $89.95
(useable in: 100 mW-5W)

B108 10W in=80W out $179.95
(1W=15W, 2W=30W) RX preamp

B1016 10W in=160W out $279.95
(1W=35W, 2W=90W) RX preamp

B3016 30W in=160W out $239.95
(useable in: 15-45W) RX preamp
(10W=100W)

220 MHz ALL MODE

C106 10W in=60W out $199.95
(1W=15W, 2W=30W) RX preamp

C1012 10W in=120W out $289.95
(2W=45W, 5W=90W) RX preamp

C22 2W in=20W out $89.95
(useable in: 200mW-5W)

RC-1 AMPLIFIER REMOTE CONTROL $24.95
Duplicates all switches, 18' cable

WATT/SWR METERS

- peak or average reading
- direct SWR reading

MP-1 (HF) 1.8-30 MHz
MP-2 (VHF) 50-200 MHz
$119.95

430-450 MHz ALL MODE

D24 2W in=40W out $199.95
(1W=25W)

D1010 10W in=100W out
(1W=25W, 2W=50W) $319.95

Available at local dealers throughout the world.

MIRAGE
COMMUNICATIONS EQUIPMENT, INC.

P.O. Box 1393, Gilroy, CA 95020 (408) 847-1857

for more than one year in our country. The SV1 prefix was given to the central part of Greece including Athens, SV2 was given to Macedonia in the northern part of Greece (including Thessaloniki), SV3 was given to Peloponnissos, SV4 to Thessalia, SV5 to Dodecanese islands including Rhodes, SV6 to Hepiros, SV7 to Thraki, SV8 to all Greek islands except Dodecanese and Crete, and the SV9 prefix was given to the island of Crete.

Subsequently, another problem came in sight with the increase of amateur population in other areas besides SV1. Local problems appeared more and more frequently and, with headquarters offices in Athens, it was almost impossible to solve them either by phone or mail. Then, during a meeting between the headquarters officials and representatives of the SV2 area, the first branch office was born in 1979. After three years of satisfactory operation of the SV2 branch office, the SV9 branch office was established in 1982.

So now there are two branch offices, with more to come in the near future.

The headquarters of RAAG are situated on the top floor of a six-story building in downtown Athens (31, Arcadias and Messogion Ave., Tel.: 01/7700835). Headquarters are open every evening from Monday to Friday, 5:00–8:00 pm. RAAG's officials welcome any foreign ham to stop by and meet the SV fellow amateurs who gather every Wednesday afternoon from 6:00–9:00 pm.

So that's all for now. Next time we'll talk about interests of Greek hams in amateur radio bands, repeater sites, equipment used, etc.

ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

This month I'd like to report on recent and upcoming events and activities here. These happenings give a picture of the life of the amateur radio community in Israel, how hams get together, and how they interact with the public at large.

Heralding in the spring was the Mount Gilboa March. "Marches" or, more properly, group hikes, are a popular event here, where sometimes thousands of people of all ages walk along certain routes. The annual march on Mount Gilboa, overlooking the Jordan and Jezreel Valleys, is sponsored by the Jezreel Regional Council at a time when the winter rains have finished and the Gilboa is speckled by abundant colorful wild flowers.

On our weekly Saturday morning roundtable and news magazine on 7.050 MHz, Moshe 4X4MJ, of Kibbutz Geva in the Jezreel Valley, suggested that for the first time hams take part in the march. The amateurs were enthusiastic, and Moshe initiated contacts between the Israel Amateur Radio Club's Special Events Committee and the organizers of the march.

Tee shirts displaying the IARC emblem were ordered and made available at half price to participating hams, who also were exempted from the entrance fee. The night before the event, a party of amateurs camped out on the Gilboa and established a base station. On the day of the march, tee-shirted amateurs were all along the route toting their two-meter hand-helds to provide emergency communications. Fortunately, outside of a few children separated from their parents, there were no real emergencies.

At the finish line, the base station, operating on the HF bands as well as VHF, proved the fact that hams are more than a group of people running around with "Motorolas" (Hebrew for handie-talkie)! As a result of the amateur participation, a few scores of impressed hikers requested information about ham radio.

In early April, on "National Communications Day" in the State of the Children Exhibit at the Tel Aviv exhibition grounds, amateurs were on hand operating a station with the special callsign 4X0ARI, under the capable supervision of Naomi 4X6DW. This also served as a drawing card to bring new recruits to the radio clubs. Incidentally, an interesting sidelight to this day was a few truckloads of government surplus "junk" being brought in to be disassembled by the kids who were told beforehand to bring along side-cutters and screwdrivers!

Israel Independence Day is marked by the very popular Annual Spring Contest. This is a national mini-contest taking place on 160, 80, 40, 2 meters, and 70 centimeters for the duration of three hours. Considering that there were perhaps no more than 80 stations active on the bands, this was definitely enough time to make the contest short and sweet, with little time needed afterwards to take care of logs.

Special recognition should go to Seth 4X6DX and Ronen 4X6II, two high schoolers who set themselves up on "Radar Hill" in the Jerusalem mountains, braving unseasonably cold winds and rains (the contest was on April 18), churning out QSOs with most of the country's eighteen contest zones, modes, and bands. (In this test, the outside world counts as one zone—no doubt the biggest zone in any ham radio competition!) Stations operating in remote areas or on emergency power get special multipliers.

There was some discontent about VHF contacts being scored the same way as those on HF, as since there was no special tropospheric skip, more remote VHF operators were at a clear disadvantage. However, I'm sure that next year's contest committee will rectify the matter. All in all, it was an enjoyable event and, for me, not having the time, patience, or nerves for weekend-long contests, was just my style. Long live mini-contests!

By the time you read this, the annual Assembly of the Israel Amateur Radio Club will have come and gone. This year it was held in June at the Wise Auditorium of the Hebrew University in Jerusalem. The Assembly is a crammed evening containing a technical lecture, a "political" forum where anyone can take the floor, the election of officers of the IARC for the year, a raffle of "junk" and door prizes, and, most important, a chance to eyeball hams from all over the country whom you've been QSOing all year long. QSLs from the bureau are distributed, and people bring the outgoing bureau manager many good kilos of sorting!

Last year, when the Assembly was held in Tel Aviv, about 800 amateurs and visitors were present. There's been a feeling among club officials that because of the shortage of time and impatience of the amateurs to get the discussions and elections over with and on to the more important raffle, not enough attention is devoted to the running of our national organization. Perhaps it is indeed time to change the format and make it a day-long hamfest/convention, as the Israeli amateur population has certainly grown since the club was founded in the early fifties. In a future column, I'll report on the Jerusalem Annual Assembly and ensuing developments.

That's it for now. Conditions between the States and Israel are at present most stable on 20 meters between 2100 and 0500 GMT, so might see you there! In the meantime, happy hamming and good DXing. Shalom and 73.

ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
21029 Milano, Italy

Having recently been named the Award and Contest Manager for the Italian Amateur Association (ARI), I will take this opportunity to give some rules of the Italian awards.

CDM—Certificate del Mediterraneo (Mediterranean Certificate). It is issued to any amateur who can show confirmation of a two-way contact since June 1, 1952, with a fixed amateur station in at least 22 countries on the list (below) and at least 30 amateur stations of peninsular Italy. The same station can be worked only once. The certificate is available in two classes: phone and CW, and phone only. Also available for the SWL. The minimum reports allowed are RST 338 and RS 33.

Following is the list of countries:

Spain, Balearic Islands, Morocco, France, Algeria, Corsica, Sardinia, Sicily, Lebanon, Egypt, Greece, Crete, Dodecanese Islands, Turkey, Syria, Yugoslavia, Albania, Malta, Gibraltar, Cyprus, Monaco, Tunisia, Israel, and Libya, plus the deleted countries of Spanish Morocco, French Morocco, and Trieste.

WAIP—Worked All Italian Provinces. This award is issued to those amateurs who can show confirmation of a two-way contact (since January 1, 1949) with a fixed amateur station in at least 60 provinces (the equivalent of US counties) of the Italian Republic. The same station may be worked twice or more if he is in different provinces. Also available for the SWL. The minimum reports are RST 338 and RS 33. List of the Italian proyinces: Agrigento Alessandria, Ancona, Aosta, Arezzo, Ascoli-Piceno, Asti, Avellino, Bari, Belluno, Benevento, Bergamo, Bologna, Bolzano, Brescia, Brindisi, Cagliari, Caltanisetta, Campobasso, Caserta, Catania, Catanzaro, Chieti, Como, Cosenza, Cremona, Cuneo, Enna, Ferrara, Firenze, Foggia, Forli, Frosinone, Genova, Gorizia, Grosseto, Imperia, Isernia, L'Aquila, Laspezia, Latina, Lecce, Livorno, Lucca, Macerata, Mantova, Massa, Matera, Messina, Milano, Modena, Napoli, Nuoro, Padova, Palermo, Parma, Pavia, Perugia, Pesaro, Pescara, Piacenza, Pisa, Pistoia, Pordenone, Potenza, Ragusa, Ravenna, Reggio-Calabria, Reggio-Emilia, Rieti, Roma, Rovigo, Salerno, Sassari, Savona, Siena, Siracusa, Sondrio, Taranto, Teramo, Terni, Torino, Trapani, Trento, Treviso, Trieste, Udine, Varese, Venezia, Vercelli, Verona, Vicenza, and Viterbo.

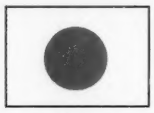
The award application has to be sent to the following address: ARI Award Manager, c/o ARI, Via Scarlatti 31, 20124 Milano, Italy, together with the complete list of QSLs, each with callsign, date, frequency, reports, time, and time of emission. Send QSLs or GCR apply. Fee: 10 IRCs or US$2.

DMG Award. Another award is a beautiful anodized-aluminum plaque with the reproduction of a photo of Guglielmo Marconi making one experimental transmission. It is available to radio amateurs worldwide. It's the DGM Award, or Diploma Guglielmo Marconi. It is not a very popular award, being a difficult one to qualify for, but it's a really beautiful plaque.

It is sent with no cost to the applicant apart from the mailing expenses (a couple of dollars). Applications have to be addressed to Roberto Borhy I4BFY, Via Toscana 133, 40141 Bologna, Italy.

To obtain the award, you have to contact and get a QSL from 40 of the following locations or 35 of the following locations plus 2 commemorative stations of Marconi, one of which must be IY4FGM. All the locations on the list are localities in which Marconi conducted his experiments. Contacts with the following locations are valid: D44 (Cape Verde), CT1 (Lisbon), CT3 (Madeira), CN8 (Morocco), EA7 (Cadice), EI (Ireland), F (France), FC (Corsica), G (London), GB (Flatholm Is.), G (Isle of Wight), GI (Ireland), GM (Scotland), HB (Switzerland), HV (Vatican), I4 (Bologna), I5 (Italy), I0 (Rome), IY4FGM, IP1TTM, IT9 (Sicily), IS0 (Sardinia), JA (Japan), LU (Buenos Aires), ON (Belgium), PY (Rio), SM (Stockholm), SM1 (Gotland), UA1 (Leningrad), VE1 (Canada), VO2 (Labrador), VO1 (Newfoundland), VK2 (Sidney), VP9 (Bermuda), W1 (Massachusetts), W2 (New York or New Jersey), W0 (Missouri), W9 (Illinois), VU (India), ZB2 (Gibraltar), YU2 (Yugoslavia), and 5A (Tripoli).

I am waiting to receive many applications! Best 73!



JAPAN

Roy Waite W9PQN
Tomigaya Grand—301
2-19-5 Tomigaya
Shibuya-Ku
Tokyo 151, Japan

RECIPROCAL AGREEMENT?

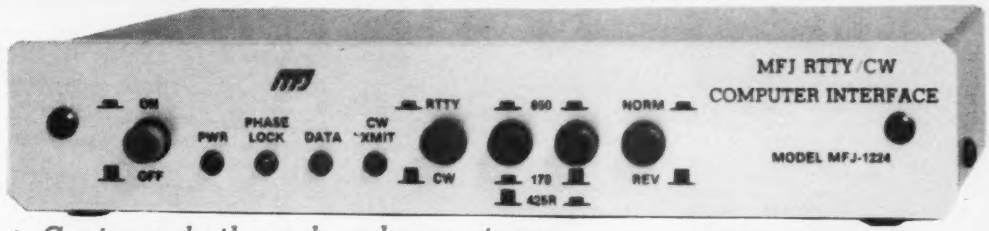
There are no reciprocal agreements with Japan, but Americans and others operate anyway.

As you know from last month's issue, Japan does not have reciprocal agreements with any country yet although a law has been passed to set things in motion. In spite of this, we have had through the years—since 1970, in fact—many non-Japanese operating ham radios in Japan. How did this come about, and why do we need a reciprocal agreement at all if "foreign" (that's you) operators can operate here anyway?

In the beginning, some time after God created the Earth, giving us light and air waves right along with all the other good things, signals coming from Japan were devoid of anything except "pure Japanese" signals. If you were assigned to Japan you might just as well pack your rig in mothballs for the duration of your stay unless, of course, you happened to come to Japan as a member of the US Armed Forces sent overseas (sometimes referred to as "Americans forced overseas"). These American military forces are given special KA callsigns and operate here quite happily just like they would in the States. The Japanese government decreed, however, that these Americans are not hams at all, and issued stern warnings to the effect that any Japanese ham having a QSO with a KA station would be punished. Following suit, the JARL will not recognize a contact with a KA station in issuing its awards. (Of course, a KA sta-

MFJ RTTY / ASCII / CW COMPUTER INTERFACE

Lets you send and receive computerized RTTY/ASCII/CW. Copies all shifts and all speeds. Copies on both mark and space. Sharp 8 Pole active filter for 170 Hz shift and CW. Plugs between your rig and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 or most other personal computers. Uses Kantronics software and most other RTTY/CW software.



- *Copies on both mark and space tones.*
- *Plugs between rig and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 and most other personal computers.*
- *Uses Kantronics software and most other RTTY/CW software.*

$99.95

MFJ-1224

This new MFJ-1224 RTTY/ASCII/CW Computer Interface lets you use your personal computer as a computerized full featured RTTY/ASCII/CW station for sending and receiving.

It plugs between your rig and your VIC-20. Apple, TRS-80C, Atari, TI-99, Commodore 64, and most other personal computers.

It uses the Kantronics software which features split screen display, 1024 character type ahead buffer, 10 message ports (255 characters each), status display, CW-ID from keyboard, Centronic type printer compatibility, CW send/receive 5-99 WPM, RTTY send/receive 60, 67, 75, 100 WPM, ASCII send/receive 110, 300 baud plus more.

You can also use most other RTTY/CW software with nearly any personal computer.

A 2 LED tuning indicator system makes tuning fast, easy and positive. You can distinguish between RTTY/CW without even hearing it.

Once tuned in, the interface allows you to copy any shift (170, 425, 850 Hz and all shifts between and beyond) and any speed (5 to 100 WPM on RTTY/CW and up to 300 baud on ASCII).

Copies on both mark and space, not mark only or space only. If either the mark or space is lost the MFJ-1224 maintains copy on the remaining tone. This greatly improves copy under adverse conditions.

A sharp 8 pole active filter for 170 Hz shift and CW allows good copy under crowded, fading and weak signal conditions. Uses FET input op-amps.

An automatic noise limiter helps suppress static crashes for better copy.

A Normal/Reverse switch eliminates retuning while stepping thru various RTTY speeds and shifts.

The demodulator will even maintain copy on a slightly drifting signal.

A +250 VDC loop output is available to drive your RTTY machine. Has convenient speaker output jack.

Phase continuous AFSK transmitter tones are generated by a clean, stable Exar 2206 function generator. Standard space tones of 2125 Hz and mark tones of 2295 and 2975 Hz are generated. A set of microphone lines is provided for AFSK out, AFSK ground, PTT out and PTT ground.

FSK keying is provided for transceivers with FSK.

High voltage grid block and direct outputs are provided for CW keying of your transmitter. A CW transmit LED provides visual indication of CW transmission. There is also an external hand key or electronic keyer input jack.

In addition to the Kantronics compatible socket, an exclusive general purpose socket allows interfacing to nearly any personal computer with most appropriate software. The following TTL compatible lines are available: RTTY demod out, CW demod out, CW-ID input, +5 VDC, ground. All signal lines are buffered and can be inverted using an internal DIP switch.

For example, you can use Galfo software with Apple computers, or RAK software with VIC-20's. Some computers with some software may require some external components.

DC voltages are IC regulated to provide stable AFSK tones and RTTY/ASCII/CW reception.

Aluminum cabinet. Brushed aluminum front panel. 8x1¼x6 inches. Uses 12-15 VDC or 110 VAC with optional adapter, MFJ-1312, $9.95.

RTTY/ASCII/CW Receive Only SWL Computer Interface

$69.95

MFJ-1225

Use your personal computer to receive commercial, military and amateur RTTY/ASCII/CW traffic.

The MFJ-1225 automatically copies all shifts (850, 425, 170 Hz shift and all others) and all speeds.

It plugs between your receiver and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 and most other personal computers.

It uses Kantronics software which features CW receive 5-99 WPM, RTTY receive 60,67,75,100 WPM, and ASCII receive 110, 300 baud. plus more.

An automatic noise limiter helps suppress static crashes for better copy, while a simple 2 LED tuning indicator system makes tuning fast, easy and positive.

In addition to the Kantronics compatible socket, a general purpose socket provides RTTY out, RTTY inverted out, CW out, CW inverted out, ground and +5VDC for interfacing to nearly any personal computer with most appropriate software.

Audio in, speaker out jacks. 4½x1¼x4¼ in. 12-15 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

ORDER ANY PRODUCT FROM MFJ AND TRY IT-NO OBLIGATION. IF NOT DELIGHTED, RETURN WITHIN 30 DAYS FOR PROMPT REFUND (LESS SHIPPING).
- One year **unconditional** guarantee • Made in USA.
- Add $4.00 each shipping/handling • **Call or write for free catalog, over 100 products.**

MFJ

MFJ ENTERPRISES, INC.
Box 494, Mississippi State, MS 39762

TO ORDER OR FOR YOUR NEAREST DEALER, CALL TOLL-FREE
800-647-1800. Call 601-323-5869 in Mississippi and outside continental U.S.A. Telex 53-4590.

VISA® MasterCard

See List of Advertisers on page 114

tion operating from US soil is a different matter and is fully recognized.)

So during those dark ages, what would one do if one were coming to Japan in a civilian capacity—say, to work for IBM or Gulf Oil or whatever? Well, as I said above, you would just put the rig in mothballs, take up knitting, scream and shout, commit hara-kiri, or, worse yet, join the US Army. These were the alternatives open to you, none of which was too satisfying.

In 1968, as we began to approach the end of the medieval age, the US sent a new ambassador to Japan, the Honorable Armin H. Meyer. Now, you wouldn't expect to get much more than perfunctory help from an ambassador when it comes to a ham radio problem. After all, it's only a hobby and doesn't stack up too well against the many important problems facing Japan and America. But you see, the good ambassador was himself a ham, whose call letters are W3ACE. Ambassador Meyer, setting his priorities in proper order, wanted to get on the air. Of course he could have opted for a military-type KA callsign and operated quite easily and comfortably from the ambassador's official residence, adjacent to the embassy. Or, as some people argued, under international treaty the US embassy is technically and legally US territory, and it is doubtful that the Japanese government would attempt to put the ambassador off the air should he fire up the rig and sign W3ACE/JA1.

But the ambassador wanted to do things right and decided that the time was ripe for a reciprocal agreement between Japan and the US. But it was not to be. Changes in the law to permit reciprocal licensing would have to be introduced to the Japanese Diet (Parliament), kicked around for discussion among many comittees and whatnot, presented to other ministries for approval, etc., which could take a lot of time. Furthermore, the Japanese "congressmen" were reportedly not in the mood to discuss amateur radio, a mere "schoolboy's hobby." Ambassador Meyer's assignment to Japan might indeed have expired before anything was done. (In retrospect, we can only say, "How true!") A more expeditious way had to be found. It was. Taking the cue from his callsign, W3ACE had one up his sleeve.

After many trips to the Japanese Foreign Ministry and Ministry of Telecommunications and Post (80, it was said), Ambassador Meyer was able to convince the Japanese authorities that when Japanese hams visit the United States they are permitted by law to operate an American friend's ham station as long as the American operator is in "control." This was certainly true; anyone, even a nonlicensed person, may speak over the microphone of a ham station in the United States.

The Ambassador argued that since this was the case, why couldn't the Japanese allow Americans the same privilege? Furthermore, the Japanese club station structure seemed ideally suited to this type of operation. In Japan, the letter Y or Z after the numeral indicates that the station is a club station, and there are hundreds, maybe thousands of them. Almost every Japanese is a member of some club, so in addition to his own personal callsign, the Japanese ham is also allowed to use a club callsign. Therefore, the argument went, why couldn't Ambassador Meyer have a Japanese "club" station installed in the embassy, and go on the air?

The authorities agreed, and made a slight modification to the Japanese ham radio laws, specifying that citizens of the US could join a Japanese club and could operate the station as long as a licensed Japanese operator was in "control." (This word, control, caused some problems in later years since it was not defined properly in the law.)

Apparently no one noticed, however, that if a Japanese operator did have a ham friend in the United States, he could talk over the microphone and actually have QSOs but was prohibited from talking to any country with which the United States did not have a third-party agreement. None existed between Japan and America. Therefore, the Japanese ham visiting America could not talk to his Japanese buddies back in his own country. On the other hand, in Japan the government was persuaded to give out operator permits to Americans under this club system, and is still doing so today. Therefore Americans can, and do, talk to any country in the world, and third-party agreements do not enter into the picture. This was not discovered immediately, but did produce some consternation among certain circles in Japan some time later.

Anyway, W3ACE was now ready to go on the air, but he needed a call. Ambassadors have connections everywhere, so it's not surprising that in rather short order some prominent Japanese hams got together and formed a club for the exclusive use of W3ACE. The law states that not more than one third of the membership of a ham club can be non-Japanese, so to be on the safe side, the membership consisted of three Japanese hams and Ambassador Meyer. In early 1970, Ambassador Meyer finally went on the air from the American embassy in Tokyo, using callsign JH1YDR, and continued to operate until his departure in 1971.

So now the doors were open. The Japanese Radio Regulatory Bureau had a special form printed so that Americans could apply for permission to operate a club station. The form was sloppily printed, contains several grammatical errors, and parts of it are somewhat puzzling and ambiguous, but that seems to fit the pattern for government forms of any kind. It does serve the purpose, however. All that one is required to do is take the original FCC license to the US embassy, have a photocopy made, and have an embassy officer swear that it is a true copy. (Embassy officers are trained to swear.) There is even a rubber stamp made for this purpose, with a place for the officer to sign. Then this copy of the license and the aforementioned form are mailed or taken in person to a Radio Regulatory Bureau office. Turnaround time is from two weeks to a month. Permission is about the size of a postcard, and expires on the date of one's visa or ham license, whichever comes first. For renewal, one follows the same steps.

Remember that this permission is only an operator's permit and not a callsign. The two are separate in Japan, and only Japanese citizens can obtain a callsign in Japan. So one of the hitches is that you have to find a friendly Japanese ham who is either willing to let you use an existing club callsign or to form a new club for you. This can take time. If you can't find a willing Japanese ham, you are just out of luck and might as well look over the alternatives I've listed above. In practice, however, I have never heard of a case where an American could not find a Japanese ham club or Japanese ham friends to form a club. Forming a club takes a little time and money (equivalent to about $25), but is not an impossibility.

One of the problems is that the Japanese have an inspection system for any station over 10 Watts. If you are content to stay within the 10-Watt power limit (that's output power, by the way), once you find the club and put in the application you can be on the air without much delay. If you want to run higher power, you will have to wait for six months or more for the inspectors to come. There is an additional fee for the inspection.

But what about the "control" of the station? Does the Japanese operator have to watch over your shoulder while you operate? Well, I can tell you that in the case of Amassador Meyer, the "control operator" definitely was not called to appear on the scene each time the rig was fired up. And, in fact, other than the first day when the station officially went on the air complete with a contingent of newspaper reporters and photographers, with the "control operator" wedged in somewhere in the crowd, Ambassador Meyer was on his own. I'm betting that that's the way he wanted it.

You may have noticed that up to this point we have limited this discussion to Americans. But what about those other countries out there? There are some others, you know. It so happened that at the same time Ambassador Meyer obtained permission to get on the air, there was (and still is) a ham in the West German embassy. Germany, this man correctly pointed out to the Japanese government, has always allowed hams from Japan (and from almost every other country, for that matter) to operate in their country. If the Americans can operate, how about the Germans? That argument brought about another modification to the law, and the Germans were then given permission to operate Japanese ham club stations just like the Americans. In more recent years, Finland and Ireland also were afforded the same privileges.

That's the story of how Americans, Germans, Finns, and Irish hams can operate from Japan even though Japan has not signed a reciprocal agreement with any country. So why do we need a reciprocal agreement? For the answer to that question, consider the following questions: What about the foreign visitor to Japan for one week? How does he find a club station or Japanese friend in such short order? Also, what if the Japanese friend who has "lent" you his club station callsign decides that he wants the call back, or what if a personal dispute arises and your Japanese sponsor decides to pull the rug out from under you? Then what do you do?

And, of course, we also have to consider the other countries. At any given time, there are any number of nationalities residing in Japan. At present, we have hams from Sweden, Italy, Great Britain, Australia, New Zealand, Canada, Philippines, and many other countries living here.

Actually, some of them are already on the air in Japan. How did they manage that since, as I have just explained, only hams from America, West Germany, Ireland, and Finland can operate here? I'll tell you about that next month. I'll also tell you about the strange situation in which certain Americans in Japan are prohibited under Japanese regulations from talking to other Americans. What complicated webs human beings weave!

LIBERIA

Mark H. Monson, M.D. EL5G
Box 1046
Monrovia, Liberia

Have you ever wondered what hamming in Liberia is like? After all, you've probably heard some EL2s on the air and maybe even worked one or two. Well, let me give you an idea of what it is like to be an amateur radio operator in Liberia.

Licenses are issued by the Liberian Telecommunications Corporation (LTC) for the Ministry of Posts and Telecommunications (P&T). LTC has authorized the Liberian Radio Amateur Association (LRAA) to administer and write the amateur examinations and recommend candidates as qualified for licensing. The president of the LRAA, Walcott Benjamin EL2BA, has appointed Lee Ruff EL2FE to write the examinations, and the president then appoints any two General-class amateurs to administer them at the site most convenient for both the examiners and the prospective amateur. A popular central location is St. Patrick's School in Monrovia, the QTH of Don Steffes EL2AL. The examinations are quite similar to those used in the US.

There are two classes of licenses, Novice and General. Novices can operate CW on any band authorized for Liberian use and phone on 2 meters. They also are allowed phone on 7.060 during the West Africa Net. They pass a simplified theory test and a 5-wpm code test, and are issued a callsign with a suffix beginning with N. Generals take a 13-wpm code test and have all privileges granted to amateurs, which include a 1-kilowatt power limit and Region 1 frequency allocations.

The Liberian government gives us no restrictions on Region 1 frequencies. We thus can operate all the usual bands that are available in the US except 6 and 1¼ meters. The P&T gave Tom Viseli EL2AV special authority to experiment and operate 6 meters, and he made many contacts which I'm sure 6-meter enthusiasts will remember.

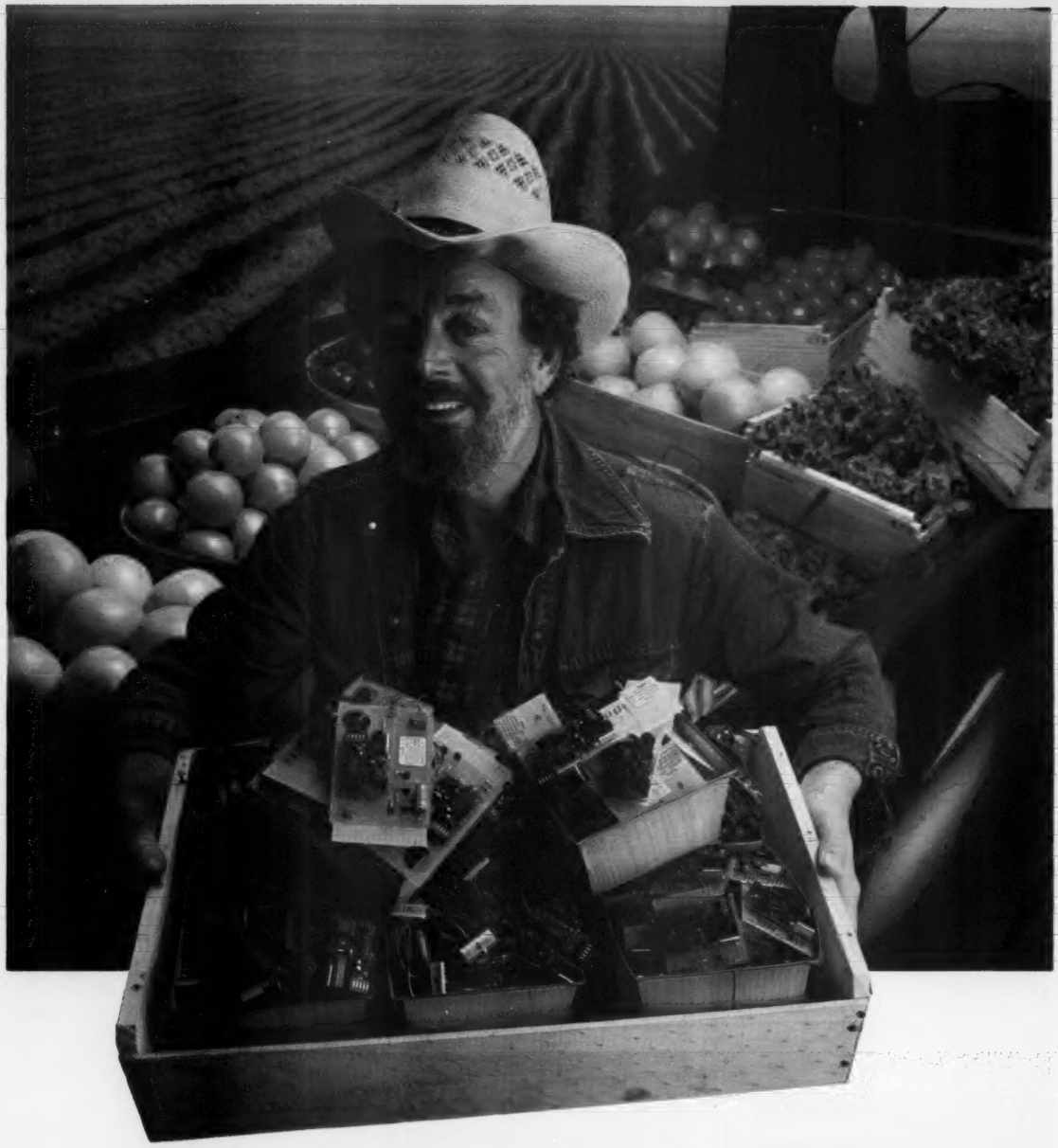
The Region 1 bands are similar to the US bands except for the obviously larger phone bands on 20, 15, and 10 meters. It seems, however, that this will not be the case much longer. Many people forget that we have smaller overall bands on 160, 80, 40, and 2 meters. The upper limit of these smaller bands are 1.85, 7.10, 3.80, and 146.0 MHz respectively. The low bands usually require split operation for phone contacts to Region 2—which is interesting if you haven't tried it before. We now can operate 30 meters, and I made the first EL 30-meter contact with a VE3 in 1982.

Licenses are issued on an annual basis and cost $35. They expire on the 31st of December every year and a one-month grace period is then in effect. Every amateur must renew his license during the month of January, which is often a major inconvenience for those of us who live outside Monrovia.

We have between 75 and 100 licensed amateurs in the country, but of course not all of them are active. Liberia has a reciprocal licensing agreement with the US, and also offers licenses on a courtesy basis to any amateurs licensed in another country. In addition, the examinations may be given and licenses issued to noncitizens. We also are allowed to run third-party traffic with the US (but not with Canada).

Those wanting to operate from Liberia should bring their licenses with them and apply when they get here. Several photographs are required. Licenses are usually issued quickly, but a month wait is not uncommon. If the stay is short, the LRAA (Box 1477, Monrovia) can assist you if you write well in advance. Things have been a little unsettled since the 1980 coup; this resulted in two months off the air, an increase in fees, changes in the licensing

Continued on page 134



Plug-In Bumper Crop

From the fertile grounds of Communications Specialists comes our fresh harvest of direct CTCSS plug-ins to spade through valuable installation time and cultivate profits. They're available for most popular mobiles, portables, and repeater panels, and all incorporate our industry standard, field programmable TS-32.

Just call our sales or engineering departments toll free from anywhere in the USA (including California) and reap what we've sown.

COMMUNICATIONS SPECIALISTS ↙34
426 West Taft Avenue, Orange, CA 92667
714/998-3021 **Entire USA 800/854-0547**

↙See List of Advertisers on page 114

TRAC

Features:
- State-of-the-Art CMOS Circuitry
- Choice of Message Storage
  - A. Six 50 character messages
  - B. Twelve 25 character messages
  - C. 27 combinations of message programming
- Records at any speed – plays at any speed
- Memory operating LED
- Use for daily QSO or contests

PLUS:
- Self-completing dots and dashes
- Both dot and dash memory
- Iambic Keying with any squeeze paddle
- 5-50 w.p.m.
- Speed, volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation—portable
- Rear panel Jack for auxiliary power
- Deluxe quarter-inch jacks for keying and output
- Keys grid block and solid rigs
- WIRED AND TESTED FULLY GUARANTEED—LESS BATTERY

CHAMPION MESSAGE MEMORY KEYER
Model TE-292
$125.95

DELUXE MESSAGE MEMORY KEYER

$89.95
Model TE-284

Features:
- State-of-the-Art CMOS Circuitry
- Three choices of Message Storage
  - A. Two (50 character each) message storage
  - B. Four (25 character each) message storage
  - C. One 50 character and two 25 character message storage
- Records at any speed plays at any speed
- Memory operating LED
- Use for daily QSO or contests

PLUS:
- Self-completing dots and dashes
- Both dot and dash memory
- Iambic Keying with any squeeze paddle
- 5-50 w.p.m.
- Speed, volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation-portable
- Deluxe quarter-inch jacks for keying and output
- Keys grid block and solid state rigs
- WIRED AND TESTED FULLY GUARANTEED—LESS BATTERY

Model # TE201

$75.95

Features:
- Advanced CMOS message memory
- Two (50 char each) message storage
- Repeat function
- Records at any speed—plays back at any speed
- Longer message capacity
  Example: send CQ CQ CQ DE WB2YJM WB2YJM K—then play second message on contact—de WB2YJM QSL NY NY 579 579 Paul Paul K
- Use for daily QSOs or contests

PLUS:
- State-of-the-art CMOS keyer
- Self completing dots and dashes
- Both dot and dash memory
- Iambic keying with any squeeze paddle
- 5-50 wpm
- Speed, volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation—portable
- Deluxe quarter-inch jacks for keying and output
- Keys grid block and solid state rigs
- WIRED AND TESTED FULLY GUARANTEED—LESS BATTERY

MESSAGE MEMORY KEYER

✓76

MODEL TE144 – Deluxe CMOS Electronic Keyer $65.95

MODEL TE133 – *same as TE144 with wgt. and tone control internal, less semi-auto keying.* $55.95

MODEL TE122 – same as TE133 less wgt., tune, solid state keying $45.95

AT YOUR DEALER OR SEND CHECK OR MONEY ORDER. (plus $2.00 s/h NY res. add tax)

TRAC ELECTRONICS, INC
1106 RAND BLDG.
BUFFALO NY 14203

PERFECT 7 ANTENNA.

FOR
10-15-20 METERS

VERTICAL
OMNI-GAIN
HALFWAVE
END FED
NO RADIALS
NO REFLECTED
POWER
BROADBAND
FIXED OR
PORTABLE
REMOTE TUNING
2 KW PEP
UPS SHIPPABLE

R3

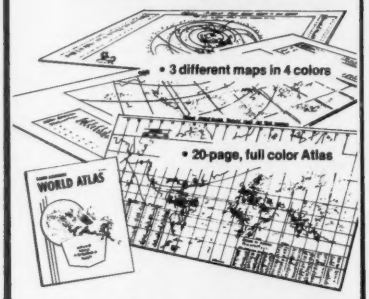
R3 may be the perfect antenna for condominiums, apartments, small lots or any limited space situation. It is a great antenna for hams who are concerned about neat appearance and maximum performance.

R3's self supporting radiator is only 21ft-6.4m high x 1ft .304m wide at the base. Assembly is quick and easy for portable, marine, field day, DX-peditions, or fixed installations. It is complete with remote tuner.

AVAILABLE THROUGH DEALERS WORLDWIDE

cushcraft
CORPORATION
THE ANTENNA COMPANY
P.O. Box 4680
Manchester, NH 03108 USA
TELEX 953050
✓106

FREE!
RADIO AMATEURS
WORLD ATLAS
with purchase of famous
CALLBOOK
MAP LIBRARY!



Here's an offer you can't refuse! You receive three, information-packed, Amateur Callbook maps, folded, plus the World Atlas for only $4.50 plus $1.50 shipping and handling. If purchased separately, total value of map/atlas offer would be $7.50 plus shipping. You save $3.00 and get these invaluable radio amateur aids!

1. **Prefix Map of the World,** folded. World-wide prefixes. Shows 40-zone map on one side, 90-zone map on the other. Size 40″ x 28″
2. **Map of North America,** folded. Includes Central America and Caribbean to the Equator. Shows call areas, zone boundaries, prefixes, etc. Size 30″ x 25″
3. **Great Circle Chart of World,** folded Centered on 40°N, 100° W. Shows cities, latitude, longitude, great circle bearings and more! Size 30″ x 25″

Plus special FREE bonus!
The Callbook's own **Radio Amateur World Atlas, FREE** with the purchase of the 3 maps. Contains eleven full color maps of the world, looking at things from the radio amateurs point of view.

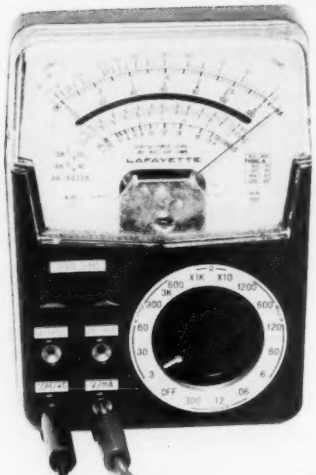
Callbook Map Library	$4.50
Shipping	1.50
Total	$6.00

Special Offer!
Amateur Radio Emblem Patch
only $2.50 prepaid
Pegasus on blue field, red lettering. 3″ wide x 3″ high. Great on jackets and caps. Sorry, no call letters.
ORDER TODAY!

Order from your favorite electronics dealer or direct from the publisher. All direct orders add $1.50 for shipping. Illinois residents add 5% Sales Tax.

RADIO AMATEUR **callbook** INC. ✓61
Dept. B
925 Sherwood Drive
Lake Bluff, Ill. 60044

MAXIMIZE YOUR POTENTIAL WITH 73!



73: Amateur Radio's Technical Journal gives you more easy-to-build construction projects and circuit designs than any other magazine of its kind. Informative articles by the dozens, on all phases of amateur radio, written by hams for hams.

73 always keeps you one step ahead with...

- Scores of useful building projects you'll enjoy by the hour.
- In-depth equipment reviews, guaranteed to save you time, trouble and money.
- 73 International—delivers all the facts you need about licensing laws, club news, contests, and awards all around the globe.
- DXing—valuable tips for newcomers, the personalities behind the callsigns, what's happening on the DXpedition scene, and much, much more!
- New Ham Bands—timely reports on the new WARC bands, how to modify your rig to use them, what to do about antennas.
- Satellite TV—keep up with the technology and all the latest developments in satellite communications.

PLUS

- RTTY—with over 30,000 hams owning microcomputers, RTTY is developing a whole new life. 73 gives you more articles on RTTY than all the other magazines combined.
- Ham Help—puts you in touch with other readers to get hard-to-find parts, schematics, and owner's manuals.
- Contests—rules and results keep you informed about ham radio's competitive side.

Subscribe to 73 today! We'll keep you involved, informed, and completely entertained. To order, simply send in the attached order form, the coupon, or call toll free **1-800-258-5473**. And if you include payment or charge card information you'll get a 13th issue FREE!

Yes, I want to subscribe to **73: Amateur Radio's Technical Journal.** I understand that with payment enclosed or credit card order I will receive a free issue making a total of 13 issues for $19.97

☐Check enclosed/MO ☐MC ☐VISA ☐AE ☐Bill me

Card# _____ Exp. Date_____

Signature _____

Name _____

Address _____

City_____ State_____ Zip_____

Canada & Mexico $22.97/1 yr. only US funds drawn on US bank.
Foreign surface $39.97/1 yr. only US funds drawn on US bank.
Foreign airmail please inquire
Please allow 6-8 weeks for delivery

339F6

73: Amateur Radio's Technical Journal•PO Box 931•Farmingdale, NY 11737

HUSTLER

DELIVERS RELIABLE ALL BAND HF PERFORMANCE

Hustler's new 6-BTV six-band trap vertical fixed station antenna offers all band operation with unmatched convenience. The 6-BTV offers 10, 15, 20, 30, 40, and 75/80 meter coverage with excellent bandwidth and low VSWR. Its durable heavy gauge aluminum construction with fiberglass trap forms and stainless steel hardware ensures long reliability.

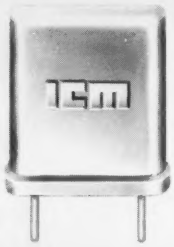
Thirty meter kits (30-MTK) for 4-BTV and 5-BTV are also available.

Don't miss our 30 meter excitement.

HUSTLER –
STILL THE STANDARD OF PERFORMANCE.

HUSTLER®
3275 North "B" Avenue
Kissimmee, Florida 32741

An Antenna Specialists Company



THERE IS A DIFFERENCE IN QUARTZ CRYSTALS.

International's leadership in crystal design and production is synonymous with quality quartz crystals from 70 KHz to 200 MHz. Accurately controlled calibration and a long list of tests are made on the finished crystal prior to shipment.

That is why we guarantee International crystals against defects, material and workmanship for an unlimited time when used in equipment for which they were specifically made.

Orders may be placed by Phone: 405/236-3741. TELEX: 747-147. CABLE: Incrystal · TWX: 910-831-3177 · Mail: International Crystal Mfg. Co., Inc., 10 North Lee, P.O. Box 26330, Oklahoma City, OK 73126.

Write for Information

ICM ↩36

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee, P.O. Box 26330, Oklahoma City, OK 73126

TS430S FILTER DEAL

For superior performance at lower cost, use top-rated 8-pole Fox Tango crystal filters to fill the optional spots in your rig. For example, our 1800 Hz FT2808 equivalent of the YK88SN has a 60/6dB shape factor of 1.7 compared with 2.0, a price of $55 vs $63, and squarer shoulders at the top with steeper skirts all the way down to more than – 80dB.

For more pleasant audio use our 2100 Hz for SSB and/or our 6000 Hz for AM. For CW, our 400 Hz unit is better than the YK88C, while our 250 Hz is sharper than the YK88CN. The more you buy, the more you save!

BIGGER IS *BETTER!*

Fox Tango filters are better because of their *discrete crystal* (not monolithic) construction. This makes them slightly larger than YK filters so they are patched into the circuit with short lengths of coax. Installation is easy — no drilling or circuit changes. Order with confidence.

INTRODUCTORY PRICES — Complete Kit
Any ONE filter..... $55
Any TWO filters..... $100 *(Save $10)*
Any THREE filters..... $145 *(Save $20)*
Includes all needed cables, parts, detailed instructions. Specify the type(s) desired.
AM — FT2811 (6000 Hz Bandwidth)
CW — FT2801 (250 Hz); FT2802 (400 Hz)
SSB — FT2808 (1800 Hz); FT2809 (2100 Hz)
Shipping $3 per order. ($5 air) FL Sales Tax 5%

ONE YEAR WARRANTY
GO FOX-TANGO—TO BE *SURE!*
Order by Mail or Telephone.
AUTHORIZED EUROPEAN AGENTS
Scandinavia MICROTEC Makedien 26
3200, Sandefjord, NORWAY
Other INGOIMPEX, Postfach 24 49
D-8070, Ingolstadt, W. GERMANY

FOX TANGO CORPORATION
Box 15944 H, W. Palm Beach, FL 33416
(305) 683-9587 ↩8

TRS-80® MODEL III DISK SOFTWARE

— TRSDOS® COMPATIBLE —

PROGRAM	DISK-PAK I	REGULAR
Super-Log		$ 19.95
Custom Beam Heading		$ 26.95
Compu-Log		$ 16.95
Antenna Anatomy		$ 14.95
Super Duper		$ 9.95
Micro-Clock		$ 9.95
Micro-DX		$ 9.95
IRC Management		$ 9.95
ONLY $49.95		**$118.60 VALUE**

— ADD $3.00 Shipping/Handling —

PROGRAM	DISK-PAK II	REGULAR
Novice Theory Review		$ 19.95
General Theory Review		$ 19.95
Advanced Theory Review		$ 19.95
Extra Theory Review		$ 19.95
Morse Code Trainer		$ 16.95
ONLY $29.95		**$ 96.75 VALUE**

OFFER BY MAIL ORDER ONLY
Write For Detailed Brochure

MICRO-80 INC.
2665 SOUTH BUSBY ROAD ↩27
OAK HARBOR, WA 98277

ASSOCIATED RADIO

8012 CONSER BOX 4327
OVERLAND PARK, KANSAS 66204

913-381-5900

BUY—SELL—TRADE

All Brands New & Reconditioned

YOU WANT A DEAL — WE WANT TO DEAL
CALL NOW!!!

MasterCard VISA

SAVE—SAVE—SAVE

NOTE: SEND $1.00 FOR OUR CURRENT CATALOG OF NEW AND RECONDITIONED EQUIPMENT
SEND $1.00 FOR OUR WHOLESALE LIST OF UNSERVICED & OVERSTOCK ITEMS.
SEND $2.00 FOR BOTH. THEY WILL BE MAILED SEPARATELY.

WORK THE U.H.F. BANDS

Add a transverter or converter to your existing 10m, 6m or 2m equipments. Choose from the largest selection of modules available for DX, OSCAR, EME, ATV.

TRANSVERTERS

MMT 50-144 $189.95
MMT 144-28 $179.95
MMT 432-28 (S) $269.95
MMT 439-ATV $349.95
MMT 1296-144 $339.95
OTHER MODELS AVAILABLE
write for details

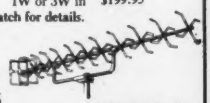
POWER AMPLIFIERS

all models include RF VOX & Low Noise RX Pre-Ampl.
(no pre-amp in MML432-100)

2 Meters:	100W output	MML144-100-LS	1W or 3W in	$254.95
	100W output	MML144-100-S	10W input	$264.95
	50W output	MML144-50-S	10W input	$214.95
	30W output	MML144-30-LS	1W or 3W in	$109.95
	25W output	MML144-25	3W input	$114.95
432 MHz:	100W output	MML432-100	10W input	$399.95
	50W output	MML432-50	10W input	$239.95
	30W output	MML432-30-L	1W or 3W in	$199.95
1268-1296 MHz:	Coming soon. Watch for details.			

ANTENNAS (incl. 50 ohm balun)

2 Meter J-Beams:	12.3 dBd gain	
8 over 8 Horizon'l pol	D8-2M	$63.40
8 by 8 Vertical pol	D8-2M-vert	$76.95
1250-1300 MHz Loop-Yagi	1296-LY	$44.95
70 cm/MBM 48		$75.75
70 cm/MBM 88		$105.50



70/MBM 48

Send 36¢ stamps for full details of all our VHF/UHF items.

Pre-selector filters Pre-amplifiers Antennas
Low-pass filters Transverters Crystal Filters
Varactor triplers Converters

SI

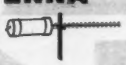
Spectrum International, Inc.
Post Office Box 1084S
Concord, Mass. 01742 USA ⌐436

VISA MasterCard

2300 MHz

BUILT	KIT
CONVERTER ANTENNA POWER SUPPLY	PC BOARD ALL PARTS DOWN CONVERTER
NOW 77.90	9.95

DISK YAGI ANTENNA $12.95
COMPLETE KIT WITH PVC AND MOUNTING BRACKET



POWER SUPPLY $15.95
VARIABLE 4 TO 15 VOLTS

ALUMINUM CABINET $6.95
ANODIZED BLACK WITH BRUSHED FINISH
ALL HOLES ARE PRE-PUNCHED

BUILT CONV BOARD $22.50
BUILT P/S & CABINET $34.95
COMPLETE SYSTEM BUILT $77.90

TRIONYX INC

AE VISA

ADD $5.00 FOR SHIPPING & HANDLING
NO COD

6219 COFFMAN RD ⌐104
INDIANAPOLIS, INDIANA 46268
317 291 7280 PHONE OR MAIL ORDER

⌐See List of Advertisers on page 114

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

DARC CORONA 10-METER RTTY CONTEST
1100–1700 GMT September 3

This is the third of four tests during the year sponsored by DARC to promote RTTY activity on the 10-meter band. (The 4th will be on November 6.) Each of the four tests is scored separately. Use the recommended portions of the 10-meter band.

EXCHANGE:

RST, QSO number, and name. US stations also give state.

SCORING:

Each station can be contacted only once. Each completed 2×RTTY QSO is worth 1 point. Multipliers include the WAE and DX-CC lists, each district in VE/VO and VK, plus each different US state. The final score is the total number of QSOs times the total multiplier.

AWARDS:

Awards to the leading stations in each class with a reasonable score present. Operating classes include: Class-A for single or multi-op, and Class-B for SWLs.

ENTRIES:

Official logs are recommended and are available from the contest manager (SASE or IRCs are appreciated). Logs must contain name, call, and full address of participant. Also show class, times in GMT, exchange, and final score. SWLs apply to the rules accordingly. Logs must be received within 30 days after each test. Send all entries to: Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany.

CRAY VALLEY RADIO SOCIETY SWL CONTEST
Starts: 1800 GMT September 10
Ends: 1800 GMT September 11

Up to 18 hours of logging may be done during the contest period with a rest period clearly shown. Multi-operator stations may log during the entire contest. The contest is open to anyone in the world, and there will be two sections, phone and CW, each with two categories: single operator and multi-operator. The second category is open to two or more listeners or to clubs and more than one receiver may be used. The 1.8-, 3.5-, 7-, 14-, 21-, and 28-MHz bands may all be used.

For the purpose of this contest, the practice of logging a series of contacts made by one station is deprecated. Log entries must not include the same callsign in the station-worked column more than five times on each band.

Scores should be compiled as follows: one point for each station heard multiplied by the number of different countries heard on each band. A list of countries heard must be furnished and a separate log must be submitted for each band. Illegible logs will not be accepted.

The call areas of the USA, Canada, and Australia will each count as a separate country. All other countries will be determined by the official RSGB/ARRL Countries List. No CQ or QRZ or similar call will be allowed to count for points. If points are claimed for both sides of a QSO, the callsign of each must appear in the station-heard column.

Log sheets are available from Owen Cross G4DFI, 28 Garden Avenue, Bexleyheath, Kent DR7 4LF, England, if you include a large SAE and sufficient return postage. It is desirable that entrants use official log sheets, but entries on home-made log sheets will be accepted if the following information is given: date, time, band station heard, station being worked, report at SWL's QTH. Points may be claimed only for stations actually heard and the callsign must be shown in full.

Entries should be sent to the Contest Manager, G4DFI, at the above address, to arrive no later than October 31st. Certificates of merit will be awarded at the discretion of the board of the Cray Valley RS, and its decision will be final.

RF-CARRIER

NEWSLETTER OF THE MONTH

The Dayton Amateur Radio Association is best known for its hamvention—but this month's newsletter contest winner, the *RF-Carrier*, proves that DARA is not all show.

The *RF-Carrier* is the message-bearer for this incredibly active club. Not only do the members put on the largest amateur radio convention to be found, but they also operate three repeaters (one on 2 meters, one on 70cm, and a 440-MHz video repeater), maintain an emergency communications van with more gear than you could find in Elmer's basement, and supply people and equipment for public-service events. Not to mention a color weather radar and a local addition to the Westlink broadcast, appropriately named Dayton Link.

You might think that a newsletter editor would have his hands full keeping the members up to date on just those activities, but somehow *RF-Carrier* Editor Bob McKay N8ADA finds time for more goodies—like "Uncle Augie's Corner," a humorous feature from the Amateur Radio News Service; and "Bits and Pieces," a collection of interesting news shorts, updates on members, and general information.

And at a time when newsletter editors are scurrying helter-skelter for word processors and hard-to-read dot-matrix printers, the *RF-Carrier* is still typed—uncompressed, large type that is easy on the eyes.

It may not be the easy way to prepare a newsletter, but it is evident that, to McKay and the members of DARA, the best quality is worth the extra effort.

If you would like to enter your newsletter in *73*'s contest, put us on your mailing list. Send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

IARS/CHC INTERNATIONAL CONTEST
CW
Starts: 0000 GMT September 10
Ends: 2400 GMT September 11
SSB
Starts: 0000 GMT September 17
Ends: 2400 GMT September 18

This is a semi-annual contest sponsored by the International Amateur Radio Society and Certificate Hunters Club. Work stations once per band; no repeaters or crossmode contacts allowed. Look for stations calling "CQ CHC."

EXCHANGE:

RS(T), IARS and/or CHC number, and state, province, or country.

FREQUENCIES:

CW—70 kHz from the bottom of the band.
SSB—3960, 7260, 14300, 21360, 28600.

SCORING:

Multiply QSOs times the number of countries worked, times the number of IARS/CHC members worked. Any member of both divisions counts as two multipliers!

AWARDS:

Engraved plaque to the highest overall score. Certificates awarded to the highest scorer per band and to the top 10 runners up.

ENTRIES:

Logs must show date and time in GMT, station worked, exchanges sent and received, QSO points claimed, and final claimed score. All entries with 100 or more QSOs must also include a check sheet. Entries must be mailed by December 1st to Ted Melinosky K1BV, 525 Foster St, South Windsor CT 06074. Include a large SASE for a copy of the results.

WASHINGTON STATE QSO PARTY
0100 to 0700 GMT September 17
1300 GMT September 17 to 0700 GMT September 18
1300 GMT September 18 to 0100 GMT September 19

The eighteenth annual contest sponsored by the Boeing Employees' Amateur Radio Society (BEARS) is divided into 3 operating periods as show. All amateurs are invited to participate. All bands (except 10.10 to 10.15 MHz) and modes may be used, but no CW QSOs are allowed in the phone bands. Stations may be worked once on each band and mode for contact points and more than once each band/mode if they are additional multipliers.

EXCHANGE:

QSO number, RS(T), and state, province, country, or Washington county.

FREQUENCIES:

Phone—1815, 3925, 7260, 14280, 21380, 28580.
CW—1805, 3560, 7060, 14060, 21060, 28160.
Novice—3725, 7125, 21150, 28160.

SCORING:

Washington stations score 2 points for each phone contact and 3 points for each CW contact, including contacts with other Washington stations. Multiply QSO points by the total number of different states, Canadian provinces, and other foreign countries worked.

All others score 2 points for each phone contact and 3 points for each CW contact with a Washington station. Multiply QSO points by the total number of different

CALENDAR

Sep 3	**DARC Corona 10-Meter RTTY Contest**
Sep 9–11	**Connecticut Oyster Festival**
Sep 10–11	**ARRL VHF QSO Party**
Sep 10–11	**Cray Valley Radio Society SWL Contest**
Sep 10–11	**IARS/CHC International Contest—CW**
Sep 17–18	**IARS/CHC International Contest—SSB**
Sep 17–18	**Scandinavian Activity Contest—CW**
Sep 17–19	**Washington State QSO Party**
Sep 17–19	**Kansas State QSO Party**
Sep 24–25	**Scandinavian Activity Contest—Phone**
Oct 1–2	**California QSO Party**
Oct 1–3	**Oregon QSO Party**
Oct 8–9	**ARRL QSO Party—CW**
Oct 9–10	**ARRL QSO Party—Phone**
Oct 15–16	**ARRL Simulated Emergency Test**
Oct 15–16	**Maryland/DC QSO Party**
Oct 15–16	**Scout Jamboree On The Air**
Oct 22–23	**MF Runde SW Activity Weekend**
Oct 22–23	**Clara Ac-Dc Contest**
Oct 22–23	**QRP ARCI Fall QSO Party**
Oct 22–23	**Pennsylvania QSO Party**
Nov 5–6	**ARRL Sweepstakes—CW**
Nov 6	**DARC Corona 10-Meter RTTY Contest**
Nov 19–20	**ARRL Sweepstakes—Phone**
Dec 3–4	**ARRL 160-Meter Contest**
Dec 10–11	**ARRL 10-Meter Contest**
Feb 4–5	**South Carolina QSO Party**
Feb 18–19	**America Radio Club International DX Contest**

Washington counties worked (39 maximum). There will be an extra multiplier of one for each group of 8 contacts with the same Washington county for all non-Washington stations.

AWARDS:

Certificates will be awarded to the highest-scoring station (both single and multi-operator) in each state, Canadian province, foreign country, and Washington county. Additional certificates may be issued at the discretion of the contest committee. Worked Five BEARS Awards are also available to anyone working 5 club members before, during, or after the QSO Party, unless previously issued. (All QSO Party entries will be screened by the contest committee for possible Worked Five BEARS Awards.) Worked Three BEAR Cubs Awards are also available for working 3 Novice members. All BEARS awards besides QSO Party certificates are handled by Doyel Burleson WA7HKD, Award Chairman. (See *73* for August, 1979, page 28, for additional details.)

ENTRIES:

Logs must show dates/times in GMT, stations worked, exchanges sent and received, bands and modes used, and scores claimed. Include a dupe sheet for entries with more than 200 QSOs. Each entry must include a signed statement that the decision of the contest committee will be accepted as final. No logs can be returned. Results of the QSO Party will be mailed to all entrants and an SASE is NOT required. Log sheets and summary sheets must be postmarked no later than October 19 and sent to: Boeing Employees' Amateur Radio Society, c/o Willis D. Propst K7RS, 18415 38th Avenue South, Seattle WA 98188.

KANSAS STATE QSO PARTY
0100 to 0700 GMT September 17
1300 GMT September 17 to 0700 GMT September 18
1300 GMT September 18 to 0100 GMT September 19

This is the second annual contest sponsored by the Boeing Employees' Amateur Radio Society of Wichita (BEARS0) and all amateurs are invited to participate. Use all bands (except 10 MHz) and modes. Stations may be worked once on each band and each mode for contact points, more than once each band/mode if they are additional multipliers.

EXCHANGE:

QSO number; RS(T); and state, Canadian province, foreign country, or Kansas county.

FREQUENCIES:

Phone—1815, 3925, 7260, 14280, 21380, 28580.

CW—1805, 3560, 7060, 14060, 21060, 28160.

Novice—3725, 7125, 21150, 28160.

SCORING:

Kansas stations score two points for each phone contact and three points for each CW contact, including contacts with other Kansas stations. Multiply contact points by the total number of different states, Canadian provinces, and other foreign countries worked. All others score two points for each phone contact and three points for each CW contact with a Kansas station. Multiply contact points by the total number of different Kansas counties worked (105 maximum). For all stations multipliers are counted only ONCE regardless of how many bands or modes they are worked on. However, there will be an additional multiplier of one for each group of eight contacts with the same Kansas county for all non-Kansas stations.

AWARDS:

Certificates will be awarded to the highest scoring station (both single and multi-operator) in each state, Canadian province, foreign country and Kansas county. Additional certificates may be awarded at the discretion of the contest committee.

Worked Five Kansas BEARS Awards are also available to anyone working five club members before, during, or after the QSO Party. All QSO Party entries will be screened by the contest committee for possible Worked Five Kansas BEARS Awards. All Kansas BEARS awards are administrated by Mike Thornton WA@TAH, Contest Chairman.

ENTRIES:

Logs must show dates and times in GMT, stations worked, exchanges sent and received, bands and modes used, and scores claimed. Include a dupe sheet for entries with more than 200 QSOs. Each entry must include a signed statement that the decision of the contest committee will be accepted as final. No logs can be returned. Log and summary sheets are available for an SASE from the contest chairman. Entries must be postmarked no later than October 20 and sent to: Boeing Employees' Amateur Radio Society of Wichita, c/o Mike Thornton WA@TAH, 1001 Munnell Ave., Wichita KS 67213.

SCANDINAVIAN ACTIVITY CONTEST
CW
Starts: 1500 GMT September 17
Ends: 1800 GMT September 18
Phone
Starts 1500 GMT September 24
Ends: 1800 GMT September 25

Object of the contest is to encourage activity on the part of Scandinavian and

RESULTS

73'S WORLD SSB CHAMPIONSHIP CONTESTS—1983 CLAIMED SCORES

40 Meters (Single Operator) W/VE

W1WEF	CT	13,728
N@DQS	IA	12,485
KA2EAY	NY	9,416
N7BUP	AZ	9,350
NF4F	TN	9,050

40 Meters (Multi-Operator) W/VE

K3TUP	PA	120,063
K8ND	OH	113,646
K5LZO	TX	81,512
KC@SZ	CO	76,713
KB@QA	SD	42,742

40 Meters (Multi-Operator) DX

4M3AZC	Venezuela	124,805
IO3MAU	Italy	83,447
OK1TN	Czech	77,940
CT4NH	Portugal	74,888
PY5EG	Brazil	69,064

40 Meters (Multi-Operator)

I5NPH	Italy	149,051
I4OUT	Italy	126,524
DA1TN	West Germany	47,736
JI1QQI	Japan	1,806

80 Meters (Single Operator) W/VE

KG1E	MA	83,104
N5AU	TX	82,156
N8II	WV	61,146
W3USS	MD/DC	54,984
KC8JH	OH	42,297

80 Meters (Multi-Operator) W/VE

N4TY	KY	41,106
K1WW	NH	39,933
K5LZO	TX	31,088
KA4JNC	VA	31,050
N8AKY	MI	25,216

80 Meters (Single Operator) DX

YV3BRF	Venezuela	132,108
IO3MAU	Italy	88,284
HI8GB	Dom. Rep.	75,330
C6ADV	Bahamas	32,550
CT4NH	Portugal	10,700

80 Meters (Multi-Operator) DX

I5NPH	Italy	101,092
JA2YKA	Japan	1,185

160 Meters (Single Operator) W/VE

KC8JH	OH	279,000
AAIK	DE	266,660
K@HA	NE	223,650
KV@Q	CO	194,370
K6SE	CA	191,750

160 Meters (Multi-Operator) W/VE

K8ND	OH	330,330
WA2SPL	NY	325,230
WB8JBM	OH	289,600
W4CN	KY	271,450
N7DF	KS	195,880

160 Meters (Single Operator) DX

YV3AZC	Venezuela	22,420
YV2IF	Venezuela	10,005
XE1HHA	Mexico	8,875
EA3CCN	Spain	3,640
OK1JDX	Czech	1,560

160 Meters (Multi-Operator) DX

YU7JDE	Yugoslavia	3,680

Full details of these very popular events will be featured in an upcoming issue.

RESULTS

1982 CRAY VALLEY RADIO SOCIETY 12TH SWL CONTEST

Name and Callsign	QSOs	Country Multipliers	Total
CW Section Single Operator			
John Alley WI-SWL	342	110	*37620
Jim Dunnet BRS 30694	239	126	*30114
Corker Rhines W8-SWL	174	82	14268
Neil Coxhead G-SWL	117	37	4329
Multi-operator			
Ray Smith and David Newland W5-SWLs	354	122	*43188
Phone Section Single Operator			
Jean-Jacques Yerganian ONL-383	748	286	*213928
Martin Parry G-SWL	683	222	*151626
John Sutton BRS 35509	634	210	133140
David Whitaker BRS 25429	533	232	123656
Top US Operator			
Bob Hertz Berg WDX-9IIK	303	94	*28482

*Certificate winners

RESULTS

1983 VIRGINIA QSO PARTY

Plaques: High VA: KG4W—86,625; High Mobile: W4OMW/M4—4,455; High Out-of-State: AE3Y—7,200; High QRP: K@RI—236*.

AL	WA4VEK	4	NV	KA7GXO	221
AK	WB4WXE	12	NJ	W2UAP	1050
CA	W6NNV	210		W2JEK	*17
CO	KV@E	775	NM	KB5DQ	99
CN	K1BV	792	NY	W2MTA	3328
FL	K4DDB	558	TX	K5LZO	720
GA	K4BAI	120	OH	W8EAO	22
WV	W3IJT	735	OK	N5AFV	8
IL	K9BG	814	OR	WB7VBQ	1
	KI9A	*31	PA	WA3JXW	1275
IA	K@HQE	25	SD	KC@ZU	153
LA	W5WG	2492	NC	KS4S	63
ME	W1APU	840	WA	W7DRA	12
MD	AE3Y	7200	**Province—Certificate**		
MA	WA1UDH	3000	Ontario:	VE3KK	1740
WI	K9GDF	130			
MI	WB8WKQ	1628			

* = QRP No multipliers.

non-Scandinavian amateurs to work each other and to promote communications skills between amateur stations worldwide. For the purpose of this, the 25th running of this annual event, non-Scandinavian stations will try to work as many Scandinavian stations as possible. Scandinavian stations are defined by the following prefixes: LA/LB/LG/LJ (Norway), JW (Svalbard and Bear Islands), JX (Jan Mayen), OF/OG/OH/OI (Finland), OH0 (Aland Island), OJ0 (Market Reef), OX (Greenland), OY (Faeroe Island), OZ (Denmark), SJ/SK/SL/SM (Sweden), and TF (Iceland).

Operating categories include:

(a) Single Op/Single Xmtr—allband only; one person performs all operating, logging, and spotting functions. The use of multiplier spotting assistance or any other form of alerting assistance is not allowed in this category.

(b) Multi-Op/Single Xmtr—allband only; only one signal allowed at any one time on any band. The station must remain on the band for at least 10 minutes following initial transmission on that band after band change.

(c) Multi-Op/Multi-Xmtr—no limit to transmitters, but only one signal per band is allowed.

Club stations may work only multi/single or multi/multi categories. All transmitters and all receivers, including spotting equipment for a station using one and the same callsign must be located within a 500-meter radius. The same station may be worked once on each band. Only CW-to-CW and phone-to-phone QSOs are valid; no cross-mode contacts.

EXCHANGE:

RS(T) plus serial QSO number starting from 001. QSOs after 999 are numbered 1000, 1001, etc. Multi-op/Multi-Xmtr stations use separate serial numbers, starting from 001 on each band.

FREQUENCIES:

CW—3505–3575, 7005–7040, 14010–14075, 21010–21120, 28010–28125.

Phone—3600–3650, 3700–3790, 7050–7100, 14150–14300, 21200–21350, 28400–28700.

Don't forget to use only those frequencies you are authorized to use. (Above frequencies for the phone segment list non-US frequencies!) Regions 2 and 3 stations may also transmit on their frequencies above 3790 and 7100.

SCORING:

European stations count one point for every complete Scandinavian QSO on any band. Non-European stations count one point per Scandinavian QSO on 20-through 10-meter bands and three points per QSO on 80 or 40 meters.

The multiplier is the number of Scandinavian call areas worked. Note that LA1 = LB1 = LJ1! Portable stations without a district number count for the tenth area, e.g., W4XXX/OZ counts for OZ0 and G3XYZ/LA counts for LA0. OH0 and OJ0 are separate call areas. SJ9 counts for the 9th call area in Sweden. Each multiplier cannot be credited more than once per band. The final score is the total QSO points times the sum of all multipliers.

AWARDS:

Top scorer in each country as well as each US call district, in each category, both on CW and phone, will receive a contest award provided a reasonable score is made. Depending on the number of entrants from each country, the award of additional certificates will be considered by the contest committee. The top scoring single-operator stations on each continent will receive a contest plaque both on CW and phone, provided a reasonable score is made.

ENTRIES:

Signed original logs (or copies of original logs) must be submitted separately for CW and phone. Logs to be filled out in the following order: date and time in GMT, station worked, sent and received exchange, band, multipliers, and points.

All entrants must submit a summary sheet showing station callsign, category, name of operator(s) and address. Indicate number of QSOs per band less duplicates, number of duplicates per band, number of multipliers per band, QSO points per band, and final score.

All entrants must submit a multiplier sheet for each band with more than 200 QSOs. Possible duplicate QSOs must be shown in the log and counted for zero points. Each entrant shall submit a duplicate QSO sheet for each band with more than 200 QSOs. Duplicate sheet to contain worked stations listed by DXCC countries and call areas.

Logs and accompanying sheets shall be mailed no later than October 30, 1983, addressed to: SAC Contest Committee, PO Box 306, SF-00101 Helsinki 10, Finland.

Violation of amateur radio regulations applicable in the country of the contestant or of the rules of this contest, unsportsmanlike conduct, and the taking of credit for unverifiable QSOs or multipliers may lead to disqualification. A log showing more than 1% unremoved duplicate QSOs results in unconditional disqualification. Each unremoved duplicate QSO found by the contest committee results in a penalty of 5 QSOs of the same value as the duplicate.

By submitting a contest log, the entrant agrees to abide by the rules of the Scandinavian Activity contest and by the decisions of the contest committee. The committee's decisions are final and definite. Right to changes in the rules is reserved.

SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Magazine, *Pine St., Peterborough NH 03458.*

BLOOMINGTON IN
SEP 4

The 6th annual Bloomington IN hamfest will be held on Sunday, September 4, 1983, from 8:00 am to 3:00 pm, at 2335 Vernal Pike, Bloomington IN. Admission is $2.00 with no additional charge for flea-market sales. Dealer and flea-market setups start at 7:00 am. Refreshments and lots of parking will be available. Talk-in on 147.78/.18 and 146.04/.64. For further information, contact Bob Myers K9KTH, 2335 Vernal Pike, Bloomington IN 47401.

LARAMIE WY
SEP 9–10

The fourth annual High Plains Ham Roundup will be held on September 9–10, 1983, at Yellow Pine and Pole Creek Campgrounds, Medicine Bow National Forest, 10 miles east of Laramie, Interstate Highway 80, Lincoln Monument turnoff. The campgrounds have been reserved for hams and their families. Bring your own food and drink and stay as long as you wish. Roast beef will be furnished for the potluck supper on Saturday evening. There will be a bluegrass band, a barbershop quartet, and a sing-along. Talk-in on 146.25/.85, 146.22/.82, or 146.52 simplex. For further information, contact Mick Marchitelli, PO Box 731, Laramie WY 82070.

HAMBURG NY
SEP 9–10

Ham O Rama '83 will be held on Friday and Saturday, September 9–10, 1983, at the Erie County Fairgrounds (Buffalo Raceway), Hamburg NY, just south of Buffalo NY. The hours on Friday are 6:00 pm to 9:00 pm and on Saturday, 7:00 am to 5:00 pm. General admission is $3.50 in advance and $4.00 at the gate. The inside flea market is $10.00 and the outside flea market is $3.00. Features will include new equipment, video, and computer displays, technical and non-technical programs, an auction, and a radio test bench. Talk-in on .31/.91 (W2EUP). For more information, contact N. Oldfield WA2ZSJ, 126 Greenway Boulevard, Cheektowaga NY 14225.

JOHNSON CITY TN
SEP 10

The Bristol, Kingsport, and Johnson City Amateur Radio Clubs will hold the 3rd annual Tri-Cities Hamfest on Saturday, September 10, 1983, at the Gray Fairgrounds, Gray TN, midway between the three cities and just off I-81. General admission is $2.00 in advance and $3.00 at the gate; flea market, $5.00. Everything will be indoors and computer enthusiasts are welcome. For tickets or more information, write Tri-Cities Hamfest, PO Box 3682 CRS, Johnson City TN 37601.

LOUISVILLE NY
SEP 10

The area amateur radio clubs and REACT teams will sponsor the fourth annual Seaway Valley Hamfest on Saturday, September 10, 1983, rain or shine, at the Louisville Firemen's Area, Louisville NY. Tickets are $2.50 per person in advance and $3.00 per person at the gate; children under 12 will be admitted free. Registration and the flea market begin at 9:00 am (setups may begin at 7:30 am). There will be a snack bar all day. Events will include an ARRL officials forum, technical talks, an OSCAR presentation, and a magic show. The ticket includes flea-market space, either tailgating or indoors. Talk-in on .31/.91, .04/.64, .52/.52, or channel 9. For tickets, contact Lois Ierlan WA2RXO, 725 Proctor Avenue, Ogdensburg NY 13669 (include an SASE or pick up the tickets at the main gate).

MARION IN
SEP 10

The 4th annual Grant County (Indiana) Amateur Radio Club Hamfest will be held on Saturday, September 10, 1983, beginning at 8:00 am, at McCarthy Hall, St. Paul's Catholic Church, Marion IN. Donations are $2.00 in advance and $3.00 at the gate. Table reservations are $2.00 per 8-foot table. Refreshments and free parking will be available. Talk-in on 146.19/.79 or 146.52 simplex. For tickets or further information, send an SASE to Jerry Richards KA9DLJ, PO Box 1146, Marion IN 46952.

MOBILE AL
SEP 10–11

The Mobile Amateur Radio Club will sponsor the Hospitality Hamfest on September 10–11, 1983, beginning at 9:00 am, at Al's Party Palace, 2671 Dauphin Island Parkway (1 mile off I-10). Admission is free. There will be XYL and YL activities, swap tables, adequate parking, reasonable overnight rates, and good food. Talk-in on 146.22/.82. For more information, write Jim Wilder N4GUC, (205)-343-7365.

WINDSOR ME
SEP 10–11

The Augusta Emergency Amateur Radio Unit will hold the 1983 ARRL-sanctioned State of Maine Hamfest on September 10–11, 1983, at the Windsor Fairgrounds. The gate donation is still $1.00 and camping is $2.50 per night. Features will include a flea market, programs for all, speakers, commercial distributors, light meals, and the traditional Saturday bean and casserole supper. Talk-in on the 146.22/.82 repeater or on 146.52. For further information, contact N1AZH, RFD #2, Box 3678, Greene ME 04236, or phone (207)-946-7557.

MELBOURNE FL
SEP 10–11

The Platinum Coast Amateur Radio Society will hold its 18th annual hamfest and indoor swap-and-shop flea market on September 10–11, 1983, at the Melbourne Auditorium, Melbourne FL. Admission is $3.00 in advance and $4.00 at the door. Swap tables are $10.00 for one day and $15.00 for both days. Food, plenty of free parking, and tailgate space will be available. Features will include meetings, forums, and awards. Talk-in on .25/.85 and .52/.52. For reservations, tables, and more information, write PCARS, PO Box 1004, Melbourne FL 32901.

FINDLAY OH
SEP 11

The Findlay Radio Club (W8FT) will hold the 41st annual Findlay Hamfest on Sunday, September 11, 1983, from 6:30 am to 5:00 pm, at the Hancock Recreational Center, 3430 North Main Street, Findlay OH. Admission is $3.00 in advance (cutoff date is September 1st) and $4.00 at the door. Tables are $6.00 each in the arena, and outdoor flea-market car spaces are $6.00. Talk-in on 147.15/.75. For more information and reservations, write Findlay Radio Club, PO Box 587, Findlay OH 45840.

MONETT MO
SEP 11

The Ozarks Amateur Radio Society will hold the 2nd annual Ozarks Amateur Radio Club Congress & Swapfest on Sunday, September 11, 1983, beginning at 11:00 am,

at the Monett City Park, junction of highways US 60 and MO 37, Monett MO (about 40 miles southwest of Springfield MO). There is no admission charge and no charge for swappers and tailgate traders (all space available on a first-come, first-served basis). The picnic and social hour begin at 1:00 pm. Bring a single covered dish to the country-style picnic and share in the buffet. Clubs are urged to attend as a group with an intent to form an alliance to expand the event in future years. Talk-in on 146.37/.97, 146.52, and 7.250. For more information, contact OARS, Box 327, Aurora MO 65605.

CARTERVILLE IL
SEP 11

The Shawnee Amateur Radio Association will sponsor Sarafest '83 on Sunday, September 11, 1983, beginning at 7:00 am, rain or shine, at John A. Logan College, Highway 13, near Carterville IL (9 miles east of Carbondale). Admission is $3.00 at the door. Features will include new equipment and computers, displays, a flea market, ladies' activities, forums, and contests. There will be free coffee and doughnuts from 7:00 am to 8:00 am, and lunch will be available from 11:00 am to 1:00 pm. Talk-in on 146.25/.85 MHz, 146.52 MHz simplex, and 3.925 MHz. For more information, contact William May KB9QY, 800 Hilldale Avenue, Herrin IL 62948, or call (618)-942-2511 days.

JACKSONVILLE FL
SEP 16-18

The first of two Great Southern Computer and Electronics Shows will be held on September 16-18, 1983, at the Veterans Memorial Coliseum, Jacksonville FL. Features will include computer hardware and software, peripherals, accessories, and word and data processing. Exhibits will include commercial and personal electronics, video products, robotics, and communications equipment. There will also be classes, workshops, seminars, and panel discussions. For registration information, exhibitors and attendees should contact Great Southern Computer and Electronics Shows, PO Box 655, Jacksonville FL 32201, or phone (904)-384-6440.

GRAND RAPIDS MI
SEP 17

The Grand Rapids Amateur Radio Association, Inc., will hold its annual swap and shop on Saturday, September 17, 1983, beginning at 8:00 am, at the Hudsonville Fairgrounds. There will be dealers, an indoor sales area, an outdoor trunk swap area, and a food concession. Talk-in on 146.16/.76. For more information, write Grand Rapids Amateur Radio Association, Inc., PO Box 1248, Grand Rapids MI 49501.

SEBASTOPOL CA
SEP 17

The Sonoma County Radio Amateurs, Inc., will hold their indoor ham radio flea market on Saturday, September 17, 1983, from 9:00 am to 3:00 pm, at the Sebastopol Community Center, 390 Morris Street, Sebastopol CA (5 miles west of Santa Rosa, just off Hwy. 12). Admission and parking are free. Indoor flea-market spaces are $2.50 ($5.00 with a table) in advance and $3.00 ($6.00 with a table) at the door. Vendor setup starts at 8:00 am. Features will include a radio clinic and an auction in the afternoon. Refreshments will be available. Talk-in on 146.13/.73. For tickets and more information, write SCRA, Box 116, Santa Rosa CA 95404.

PEORIA IL
SEP 17-18

The Peoria Area Amateur Radio Club will hold its Peoria Superfest '83 on September 17-18, 1983, at the Exposition Gardens, W. Northmoor Road, Peoria IL. The gate opens at 6:00 am and the Commercial Building at 9:00 am. Admission is $3.00 in advance and $4.00 at the gate. Activities will include amateur radio and computer displays, a huge free flea market, a free bus for the ladies to Northwoods Mall on Sunday, and a Saturday night informal get-together at Heritage House Smorgasbord, 8209 N. Mt. Hawley Road, Peoria IL. There are full camping facilities on the grounds. Talk-in on 146.16/.76 (W9UVI). For reservations or more information, send an SASE to Superfest '83, 5808 N. Andover Ct., Peoria IL 61615.

NEW KENSINGTON PA
SEP 18

The Skyview Radio Society will hold its annual hamfest on Sunday, September 18, 1983, from noon to 4:00 pm, at the club grounds on Turkey Ridge Road, New Kensington PA. The registration fee is $2.00 and the vendor fee is $4.00. Talk-in on .04/.64 and .52 simplex.

DANBURY CT
SEP 18

The Candlewood Amateur Radio Association will hold its annual flea market on Sunday, September 18, 1983, from 10:00 am to 4:00 pm, at the Elks Lodge, 346 Main Street, Danbury CT (exit 5 off I-84). Admission is $1.00 and tables are $6.50. Features will include dealers and a magic show for the kids. Talk-in on 147.72/.12. For advance table reservations, contact CARA, PO Box 188, Brookfield Center CT 06850. For more information, phone George KC2QF at (914)-533-2758, Ken N1BVS at (203)-744-6953, or George AF1U at (203)-438-0549.

PENNSAUKEN NJ
SEP 18

The South Jersey Radio Association will hold its 35th annual hamfest on September 18, 1983, from 8:00 am to 4:00 pm, at the Pennsauken Senior High School, Hylton Road, Pennsauken NJ. Tickets are $2.50 in advance and $3.50 at the gate; tailgaters are $5.00. Refreshments will be available. Talk-in on .22/.82 and .52. For more information, contact Fred Holler W2EKB, 348 Bortons Mill Road, Cherry Hill NJ 08002, or phone (609)-795-0577.

VENICE OH
SEP 18

The forty-sixth annual 1983 Cincinnati Hamfest will be held on Sunday, September 18, 1983, at Stricker's Grove, State Route 128, one mile west of Venice (Ross) OH. Admission and registration are $5.00. Features will include a flea market (radio-related products only), exhibits, music, talks, a hidden transmitter hunt, and an air show. Food and refreshments will be available. For more information, contact Lillian Abbott K8CKI, 317 Greenwell Road, Cincinnati OH 45238.

MT CLEMENS MI
SEP 18

The L'Anse Creuse Amateur Radio Club will hold their 11th annual swap and shop on Sunday, September 18, 1983, from 9:00 am to 3:00 pm, at the L'Anse Creuse High School, Mt Clemens MI. Take I-94 eastbound to the Metropolitan Parkway exit;

HAM WANTED

73 is looking for a technically-oriented radio amateur with hands-on electronics experience. Applicant should have a higher class ham ticket as well as considerable experience with RTTY and computers. Organizing ability and self-discipline essential. The right person will relocate to Peterborough and undertake special projects...reporting to the Chief Executive Officer...in a non-smoking environment.

Reply to:

High Tech—W
P.O. Box 654
Peterborough, N.H.
03458

TET® ANTENNA SYSTEMS

SUPER HB9CV BEAMS THE BEST!

Only TET Gives You VSWR Of 1.5:1 Or Less Over The Entire Band. Phone or CW - The TET Covers It All Without A "Tuner". Rugged Construction - No Nonsense - No "Hose Clamps" - Yet Lightweight And Low Windload. TET's Dual-Drive Phasing System Offers More Gain...It's Like Adding An Extra Element! On The Air Performance? Ask a TET Owner. They Are Our BEST *Salesmen!*

NEW! 40 METER MONOBAND

HB40NL2	HB40NL3
2EL. - "TRAPLESS" 16'6" BOOM - 52 LB. 44' EL. - 6.5 dB GAIN $254.95	3EL. - "TRAPLESS" 33' BOOM - 81 LB. 44' EL. - 8 dB GAIN $379.95

HB9CV SUPER TRIBAND

HB33SP	HB43SP	HB35T
3EL. - 27 LB 13'2" BOOM $189.95	4EL. - 38 LB 19'8" BOOM $249.95	5EL. - 50 LB 24'7" BOOM $349.95

Rotors - Thrust Bearings - Swiss Quads VHF UHF Discones - HF Verticals - Etc!

CASH - CHECK - M.O. - VISA - MASTERCARD
PLEASE INCLUDE UPS SHIPPING
TO ORDER, OR FOR COMPLETE CATALOG
CALL OR WRITE:

(513)376-2700
SULTRONICS ↙245
15 Sexton Dr., Xenia, Ohio 45385

ETCO ELECTRONICS ↙248
DEPT. 590
Mailing List Control Center
Box 840
Champlain, N.Y. 12919

NOW 112 PAGES

I Enclose_____(cash OK);
Please rush postpaid

- ☐ **$1 for 1 year subscription to the world famous ETCO catalog.**
- ☐ **$3 Canadian & Foreign 1 year subscription to the ETCO catalog.**
- ☐ **304 page handbook "BUILD YOUR OWN EARTH STATION". (TA025) $10.00**
- ☐ **360 pages MASTER HANDBOOK OF TELEPHONES. (TA001) $11.00**
- ☐ **FREE - sample copy of the bargain packed ETCO catalog. (USA only)**

Name_____
Address_____
City_____
State_____ Zip_____

↙See List of Advertisers on page 114

then take the Metropolitan Parkway to Crocker; go left on Crocker to Reimold and then right on Reimold to the last school, L'Anse Creuse High School. Admission is $1.00 in advance and $2.00 at the door. FCC representatives will be there, as well as plenty of new and used gear. There will be lots of food and parking. Talk-in on 147.69/.09 and 146.52. For more information, send an SASE to Wm. Chesney N8CVC, 215 Elizabeth, Mt. Clemens MI 48043, or phone (313)-463-1412.

ELMIRA NY
SEP 24

The 8th annual Elmira International Hamfest will be held on September 24, 1983, beginning at 6:00 am, at the Chemung County Fairgrounds. Tickets are $2.00 each in advance and $3.00 each at the gate. The flea market is free; breakfast and lunch will be available at reasonable prices. Features will include tech talks and dealer displays. Talk-in on 147.96/.36, 146.10/.70, and 146.52/.52. For advance tickets, write John Breese, 340 West Avenue, Horseheads NY 14845.

WICHITA FALLS TX
SEP 24-25

The Wichita Amateur Radio Society will hold its second annual hamfest on September 24-25, 1983, at the National Guard Armory, Wichita Falls TX. Pre-registration closes Wednesday, September 21, 1983, and is $4.00 per person and $3.00 per swap table. Registration at the door is $5.00 and starts at 8:00 am both Saturday and Sunday. There is free shuttle service from the Kickapoo Airport (¼ mile south), free RV parking without hookups at the armory, and a concession stand open both days. There will be dealer displays, an inside flea market with 24-hour security, scheduled ladies' activities, contests, meetings, and many special events. Talk-in on 146.34/.94 and 147.75/.15. For more information and pre-registration, write to WARS Hamfest, PO Box 4363, Wichita Falls TX 76308.

YORK PA
SEP 24-25

The York County Amateur Radio Clubs will hold their 28th annual York Hamfest and Specialized Communications Expo on Saturday and Sunday, September 24-25, 1983 at the York Fairgrounds, Rte. 74 at the northwest edge of the city, York PA. Saturday registration is $2.00 and begins at 11:00 am; Sunday registration is $3.00 and begins at 8:00 am. Student registration is $2.00 for both days and children under 12 and XYLs will be admitted free. There will be tailgating Sunday only and gates will open at 6:00 am for tailgaters and vendors. Tailgate spaces are $3.00 per ten feet, plus registration (required for vendors and helpers). Indoor tables (with electricity) prepaid before August 1 are $5.00; $6.00 after August 1. There will be refreshments, computer displays, ladies' events, overnight camping, new equipment displays, and on Saturday, beginning at 1:00 pm, seminars and talks. Talk-in on 146.37/.97 and .52/.52. For table pre-registration and tickets, send checks to York Hamfest, Box W, Dover PA 17315.

GRAYSLAKE IL
SEP 24-25

The Chicago FM Club, Inc., will hold Radio Expo 83 on September 24-25, 1983, at the Lake County Fairgrounds, Rtes. 45 and 120, Grayslake IL (halfway between Chicago and Milwaukee). Tickets for both days are $3.00 in advance and $4.00 at the door. The flea market will open at 6:00 am and tables are available at $5.00 per day. Exhibits will open at 9:00 am. The camp area will be open Friday night and camping is free. There will be displays of communications, how-to and technical sessions, discussions with FCC and ARRL spokesmen, and a ladies' program. Talk-in on 146.16/.76, 146.52, and 222.5/224.10. For more information, write to Radio Expo, Box 1532, Evanston IL 60204, or call (312)-582-6923.

CLEVELAND OH
SEP 24-25

The Cleveland Hamfest Association will hold the Cleveland Hamfest, 1983, and the ARRL Great Lakes Division Convention on Saturday and Sunday, September 24-25, 1983, at a new location, Cleveland Aviation High School, North Marginal Road, between E 55th Street and E 9th Street, by Burke Lakefront Airport, off I-90 or I-77. The ARRL/Cleveland Hamfest Banquet will be held on Saturday, September 24th, and on Sunday, September 25th, the hamfest will be open from 8:00 am to 5:00 pm. The flea market will open at 6:00 am and spaces are $2.00 each. General admission is $3.00 and advance tickets are $2.50. Features will include forums, commercial exhibits, and ladies' activities. Breakfast and lunch will be served and overnight parking, as well as free parking in a secure area, will be available. Talk-in on 146.52 (W8QV). For advance tickets, send a check or money order before August 31, 1983, to Cleveland Hamfest Association, PO Box 93077, Cleveland OH 44101.

WILLIMANTIC CT
SEP 25

The Natchaug ARA will hold a hamfest and giant flea market on Sunday, September 25, 1983, from 9:00 am to 4:00 pm, at the Elks Home, 198 Pleasant Street (off Rte. 32), Willimantic CT. Admission is $2.00; tables are $5.00 in advance and $7.00 at the door. The ARRL-approved event will be both inside and outside and free parking will be available. Talk-in on 147.30/147.90 and 146.52. For more information, contact Edward C. Sadeski KA1HR, 49 Circle Drive, Willimantic CT 06226, (203)-423-7137, or Clifton Pease KA1HYW, 268 Main Street, Willimantic CT 06226, (203)-456-1432 after 4:00 pm.

GAINESVILLE GA
SEP 25

The 10th annual Lanierland ARC Hamfest will be held on September 25, 1983, beginning at 9:00 am, in Holiday Hall, Holiday Inn, Gainesville GA. Admission is free, as well as tables and inside displays for dealers requesting them in advance. Activities will include a large flea market, a boat-anchor auction, and a ladies' country store. Talk-in on 146.07/.67. For more information, contact Phil Loveless KC4UC, 3574 Thompson Bend, Gainesville GA 30506, or phone (404)-532-9160.

BOULDER CO
SEP 25

The Boulder Amateur Radio Club will hold its fall swapfest, Barcfest, on September 25, 1983, from 9:00 am to 3:00 pm, at the National Guard Armory, 4750 N. Broadway, Boulder CO. Admission is $3.00 per individual or per family. There will be an indoor and outdoor flea market, a snack bar, and free parking. Talk-in on 146.10/.70 and 146.52 simplex. For more information, phone Tim Groat KR0U at (303)-466-3733, or write 1000 East 10th Avenue, Broomfield CO 80020.

GARDEN CITY KS
SEP 25

The Sandhills Amateur Radio Club will hold its annual Eye-Ball QSO Party on September 25, 1983, beginning at 9:00 am, at the Finney County Fairgrounds, Garden City KS. For more information, send an SASE to SHARC, PO Box 811, Garden City KS 67846.

WOODBRIDGE NJ
OCT 1

The De Vry Technical Institute Amateur Radio Club will hold its annual flea market on October 1, 1983, from 9:00 am to 4:00 pm, in the school parking lot, 479 Green Street (between Rtes. 1 and 9), Woodbridge NJ. Admission is $3.00 for sellers and free for buyers. No electricity will be available. For further information, contact Frank Koempel WB2JKU, De Vry Technical Institute, 479 Green Street, Woodbridge NJ 07095.

SYRACUSE NY
OCT 1

The Radio Amateurs of Greater Syracuse (RAGS) will hold their annual Hamfest and Computer Display on Saturday, October 1, 1983, from 9:00 am to 6:00 pm, at the Art and Home Center, New York State Fairgrounds, Syracuse NY. Admission is $3.00 at the door. Featured will be commercial exhibitors, a large indoor and outdoor flea market, tech talks, an ARRL booth, displays, women's activities, contests, and entertainment. Hot food and beverages will be served. Talk-in on .90/.30, .31/.91, and .52 simplex. For further information, contact RAGS, Box 88, Liverpool NY 13088.

WARRINGTON PA
OCT 1-2

The Pack Rats 7th annual Mid-Atlantic VHF Conference will be held on Saturday,

NICAD MEMORY ERASE – WHAT??

- Complete automatic operation
- Erases ÷ Charges ÷ Checks
- Rapid charges in 35 min. (typically)
- Automatically repairs shorted cells
- No dangerous heat build up
- Front panel selects up to 3 different packs
- Unlimited battery combinations with program modules (user programable)
- LED status indicators
- Supplied with universal EZ hook wire leads

Specify Voltage of Battery Pack(s) with order.
One program module included – optional modules $2.25 each.

$89.00 plus $4.00 Shipping
(PA Residents add 6% sales tax)

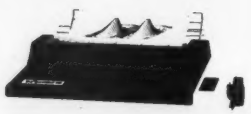
Now Available—A commercial version of the GMS 401. Designed to charge up to and including the commercial 15 volt Nicad packs. $139.00 plus same shipping and module cost as the GMS 401.

The GMS 401 is a complete automatic NICAD conditioner and rapid charger. Never before has this been offered anywhere at any price and it's so good it's being patented. NICAD memory characteristics must be dealt with otherwise your battery pack is not delivering all it could. The GMS 401 will automatically erase and rapid charge any type NICAD pack from 1 to 10 cells.

CONTROL PRODUCTS UNLIMITED, INC.
P.O. Box 10, Downingtown, PA 19335
215-383-6395 ↙25

AFFORDABLE HARDCOPY

Put your personal computer to work printing the log, QSLs, or RTTY...The **Gemini 10** by Star Micronics is a versatile dot-matrix printer that we feel is the best buy for the money. Parallel interface and both friction and tractor feed are included at this low price.



GEMINI 10 ..... $325

TO ORDER: Mail order only, check or money order. Add 6% sales tax on California orders. Allow 2 weeks for personal checks to clear. Price includes UPS shipping in continental US. Prices subject to change without notice. Circle reader service number for print sample. ↙75

Ampersand electronics
6065 Mission Gorge Rd. #66
San Diego, CA 92120

October 1, 1983, beginning at 7:30 am, rain or shine, at the Warrington Motor Lodge, Route 611, Warrington PA. Advance registration is $4.00 and includes admission to the 12th annual Pack Rats Hamarama on Sunday, October 2, 1983, at the Bucks County Drive-In Theater, Route 611, Warrington PA. Admission to the flea market is $3.00 and selling spaces are $5.00 each (bring your own table). For advance registration, phone Lee A. Cohen K3MXM at (215)-635-4942, or send a check to Hamarama '83, PO Box 311, Southampton PA 18966.

CEDAR RAPIDS IA
OCT 2

The Cedar Valley Amateur Radio Club (WØGQ) will hold its 9th annual ARRL CVARC Hamfest on Sunday, October 2, 1983, beginning at 7:00 am, at the Hawkeye Downs Exhibition Building, Cedar Rapids IA. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 for the first and $7.00 for others. There is an overnight camping area, picnic facilities, ample parking, and a concession stand. There will be movies, manufacturers, dealers, and ARRL representatives featured. Talk-in on 146.16/.76, .52, and 223.34/.94 MHz. For advance tickets or reservations, write CVARC Hamfest, PO Box 994, Cedar Rapids IA 52406.

YONKERS NY
OCT 2

The Yonkers Amateur Radio Club will sponsor the Yonkers Electronics Fair and Giant Flea Market on Sunday, October 2, 1983, from 9:00 am to 4:00 pm, rain or shine, at the Yonkers Municipal Parking Garage, corner of Nepperhan Avenue and New Main Street, Yonkers NY. Admission is $2.00 each and children under 12 will be admitted free. Gates will be open to sellers at 8:00 am and there will be a $6.00 admission per parking space which will also admit one (bring your own tables). Refreshments, free parking, and sanitary facilities will be available, as well as unlimited free coffee. There will be live demonstrations all day and a giant auction at 2:00 pm. Talk-in on 146.265T/146.865R or .52 direct. For more information, write YARC, 53 Hayward Street, Yonkers NY 10704, or phone (914)-969-1053.

REVERE MA
OCT 16

The 19-79 Amateur Radio Association of Chelsea MA will hold its annual fall flea market on Sunday, October 16, 1983, from 11:00 am to 4:00 pm (sellers admitted at 10:00 am), at the Beachmont VFW Post, 150 Bennington Street, Revere MA. Admission is $8.00 at the door, if available. Talk-in on .19/.79 and .52. For table reservations, send a check to 19-79 Amateur Radio Association, PO Box 171, Chelsea MA 02150.

BALTIMORE MD
OCT 23

The Columbia Amateur Radio Association will hold its 7th annual hamfest on Sunday, October 23, 1983, from 8:00 am to 3:30 pm, at the Howard County Fairgrounds, 15 miles west of Baltimore MD, just off I-70 on Rte. 144, 1 mile west of Rte. 32. Admission is $3.00. Indoor tailgating is $3.00 additional. Food will be available. Talk-in on 147.735/.135 and 146.52/.52. For table reservations and more information, write Ed Wallace K3EF, 9905 Carillon Drive, Ellicott City MD 21043.

SATELLITES

Amateur Satellite Reference Orbits

	Date	OSCAR 8 UTC	OSCAR 8 EQX	RS-5 UTC	RS-5 EQX	RS-6 UTC	RS-6 EQX	RS-7 UTC	RS-7 EQX	RS-8 UTC	RS-8 EQX	Date
Sep	1	0002	87	0055	53	0102	60	0146	68	0111	55	1
	2	0006	88	0050	53	0046	58	0137	67	0108	56	2
	3	0011	89	0044	53	0031	55	0127	66	0105	57	3
	4	0015	90	0039	53	0015	53	0117	65	0103	58	4
	5	0019	91	0034	53	0000	51	0108	64	0100	59	5
	6	0024	93	0028	53	0143	78	0058	64	0057	59	6
	7	0028	94	0023	54	0128	76	0048	63	0054	60	7
	8	0032	95	0017	54	0112	73	0039	62	0051	61	8
	9	0037	96	0012	54	0057	71	0029	61	0048	62	9
	10	0041	97	0007	54	0041	69	0020	60	0046	63	10
	11	0045	98	0001	54	0026	66	0010	59	0043	63	11
	12	0050	99	0156	85	0011	64	0000	58	0040	64	12
	13	0054	100	0150	85	0154	91	0150	87	0037	65	13
	14	0058	102	0145	85	0138	89	0140	86	0034	66	14
	15	0103	103	0140	85	0123	87	0130	85	0031	67	15
	16	0107	104	0134	85	0108	84	0121	85	0029	68	16
	17	0111	105	0129	86	0052	82	0111	84	0026	68	17
	18	0116	106	0123	86	0037	80	0101	83	0023	69	18
	19	0120	107	0118	86	0021	77	0052	82	0020	70	19
	20	0124	108	0113	86	0006	75	0042	81	0017	71	20
	21	0129	109	0107	86	0149	103	0033	80	0014	72	21
	22	0133	111	0102	86	0134	100	0023	79	0012	72	22
	23	0137	112	0057	87	0118	98	0013	78	0009	73	23
	24	0142	113	0051	87	0103	96	0004	77	0006	74	24
	25	0003	88	0046	87	0047	93	0153	106	0003	75	25
	26	0007	89	0041	87	0032	91	0143	106	0000	76	26
	27	0012	90	0035	87	0017	89	0134	105	0157	107	27
	28	0016	91	0030	88	0001	86	0124	104	0154	107	28
	29	0020	93	0025	88	0144	114	0115	103	0152	108	29
	30	0025	94	0019	88	0129	111	0105	102	0149	109	30
Oct	1	0029	95	0014	88	0114	109	0055	101	0146	110	1
	2	0033	96	0009	88	0058	107	0046	100	0143	111	2
	3	0038	97	0003	88	0043	104	0036	99	0140	112	3
	4	0042	98	0157	119	0027	102	0026	98	0137	112	4
	5	0046	99	0152	119	0012	100	0017	98	0135	113	5
	6	0051	100	0147	119	0155	127	0007	97	0132	114	6
	7	0055	102	0141	119	0140	125	0157	126	0129	115	7
	8	0100	103	0136	119	0124	122	0147	125	0126	116	8
	9	0104	104	0131	120	0109	120	0137	124	0123	116	9
	10	0108	105	0125	120	0053	118	0128	123	0120	117	10
	11	0113	106	0120	120	0038	115	0118	122	0118	118	11
	12	0117	107	0115	120	0023	113	0108	121	0115	119	12
	13	0121	108	0109	120	0007	111	0059	120	0112	120	13
	14	0126	109	0104	121	0150	138	0049	119	0109	120	14
	15	0130	110	0058	121	0135	136	0039	119	0106	121	15

PHASE IIIB

Recovering from a troubled beginning, Phase IIIB—now AMSAT/OSCAR 10—was boosted into a higher orbit on Monday, July 11. After correcting OSCAR 10's attitude and increasing the exposure of the solar cells, ground stations fired the kick motor for the first time at 2232 UTC. The second firing, which was scheduled for July 20, was to alter the inclination of the satellite. OSCAR 10 planners hoped to have the transponders operational by July 24.

OSCAR 10's transponders operate in two frequency ranges. The general beacon for Mode B is on 145.810 MHz, and the engineering beacon is slightly higher, at 145.987 MHz. The uplink is between 435.025 and 435.175 MHz, and the downlink is between 145.975 and 145.825 MHz. The general beacon for Mode L is on 436.020 MHz, and the engineering beacon is at 436.040 MHz. The Model L uplink is from 1269.050 to 1269.850, with the downlink between 436.950 and 436.150 MHz.

HAM HELP

I need the technical manual for an Eico model 460 oscilloscope. I will copy and return it.

H. L. Church
309 W. St. Louis St.
Lebanon IL 62254-0126

Can anyone supply me with a schematic and operating manual for the Akai VTS-150 color camera and recorder? I will pay copying costs or return the original. I could use similar data on the Morrow MB-6 receiver and the MB-565 transmitter.

Mark R. Nelson AJ2X
4317 Foley Drive
Knoxville TN 37918

CORRECTIONS

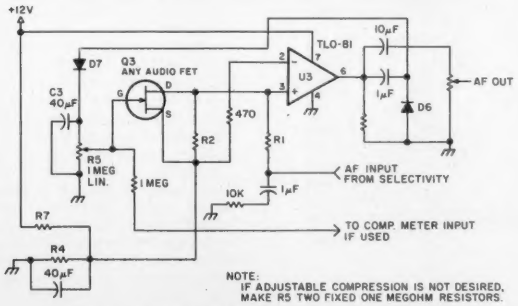


Fig. 1. Compression circuit with adjustable compression modification.

A couple of errors appeared in "What? Another Audio Filter Project?" in the November, 1982, issue of *73*. The compression and power schematic on page 33 was incorrectly drawn; it should look like Fig. 1. Fig. 1 also incorporates an adjustable compression modification. The modification described in the article will not work.

The clipper circuit on page 33 needs different component values to produce a clean output. Fig. 2 shows the circuit and new component values.

In some cases, the unit proved to be rf-susceptible. The cure is to run all of the leads from the filter through ferrite beads as they enter the case, and bypass the lead to ground with small ceramic capacitors.

George Thurston W4MLE
Tallahassee FL

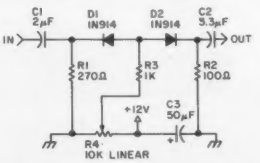


Fig. 2. Clipper circuit and new component values.

On page 12 of the July, 1983, issue, the author of "You Can Build This Code Trainer" was inadvertently omitted. The author of the article is Harry Latterman K7ZOV, 1655 W. Lindner Ave., Mesa AZ 85202.

Avery L. Jenkins WB8JLG
73 Staff

There is a way to improve the accuracy of the "VUM: Volume Units Meter," which appeared on page 72 of the August, 1982, issue. With the given values of R1-R7, the input attenuator has an error of about 10 percent. The following values will give an error of less than 1 percent: R1—6,900; R2—15k; R3—47k; R4—150k; R5—470k; R6—1.5M; and R7—4.7M.

George Thurston W4MLE
Tallahasse FL

REVIEW

SUPER-RATT RTTY/CW PROGRAM WITH RBBS

Surely you have heard the saying "Build a better mousetrap and the world will beat a path to your door." Why not turn things around and build a better "Ratt"? That's what the folks at Universal Software have done. First impressions are only worth so much, but if my judgment is correct, the world of Apple-computer-owning hams is already beating a path to the door of the maker of Super-Ratt. A software-only package, Super-Ratt is meant to be used with a 48K Apple II, Applesoft Basic, and at least one DOS 3.3 disk drive. You also need a terminal unit, one capable of interfacing to the Apple's TTL-compatible game I/O connector.

Though this review deals only with the straightforward RTTY portion of the program, Super-Ratt also offers CW transmit and receive capability and an integrated radio bulletin board (RBBS). The program itself comes on a non-protected DOS 3.3 disk and is accompanied by a professional-looking 65-page manual.

Set aside a couple of hours to get Super-Ratt running. First you'll need to make a working copy of the diskette and perhaps add some canned messages. And you will have to interface your Apple to demodulator and modulator circuits. Just about any of the popular terminal units (TU) should do the job, provided that it is TTL-compatible. Do take care to avoid hooking anything that remotely resembles high voltage to your computer, unless you want to make some repairs. For this review, a slightly modified Fiesher TU-170 was used. If you don't have a TU, then you might want to build one of the simple circuits shown in the back of the Super-Ratt manual. A third choice is the Radcom TU which plugs directly into one of the Apple's peripheral slots.

Once the set-up phase is complete, actual operation starts simply: Just insert the disk, turn on the computer, and tune in a signal. There are no menus to deal with; the program goes directly to the receive mode and its standard five-part, 24-line screen display. The top and bottom lines are devoted to prompts and status information such as the mode, speed, and buffer. The received-text area is composed of 13 forty-character lines, while the transmit type-ahead buffer contents are displayed with four lines. Another four lines are used to denote boundaries, and the final line, situated between the receive and transmit display regions, is a scrolling readout of what is being sent during transmit. For tuning purposes, there is a mark/space indicator on the top status line.

Typing a combination of the control shift and P keys stops the receive function and brings up the help screen. There are 27 control codes, some of which you may use numerous times in each QSO; others you may never touch. "Joe Ham" will probably find the following most useful: Control-I inverts the mark/space sense; Control-K is for CW identification; Control-X, when put at the end of the transmit buffer, automatically switches the system back to receive; and Control-T is used for "break-in" operation for times when you want to make a quick reply and not disturb the type-ahead buffer. Other commands switch the speed or mode (Baudot, ASCII, and Morse) and let the operator erase the transmit or receive buffer contents.

The commands mentioned so far give an operator as many or more features than were usually found in an old-time mechanical RTTY station. The remaining 20+ Super-Ratt commands are like the icing on the cake. Among other things, they permit you to use an almost full screen for receiving, load and save disk files, have the buffer contents automatically stored to disk, make entries in a disk-based logbook, define and then use up to eleven different temporary sequences (i.e., the other op's callsign), and relay the last received transmission.

Besides straightforward CW and RTTY operation, Super-Ratt offers RBBS, selcal, and shortwave-listening capability. The following is just a brief introduction to these modes:

- RBBS (Radio Bulletin Board System) "...allows other people to use your computer as a message center. You do not need to actually operate your station yourself. The Apple II will do all the work." (From the Super-Ratt manual.) A quick spin across the RTTY portion of 40 or 80 meters will demonstrate the popularity of radio bulletin boards. If you decide to become a "sysop" (owner and operator of an RBBS), then be prepared to dedicate a rig, antenna, and computer to the project plus be willing to maintain the user-generated files frequently. Note: Be sure to check the FCC rules concerning unattended operation.

The Super-Ratt RBBS software has several unique features. Users can call up to four analog readouts that are based on inputs to the Apple game port, turn on a tape recorder and leave a voice message (VHF bands only), and switch the system to other codes and speeds.

- Selcal, or selective calling, puts Super-Ratt on guard for a password. As soon as it is received, the computer beeps and displays the time.
- SWL or shortwave listening: If you tire of the ham bands, then try tuning across the commercial spectrum. You'll find plenty of RTTY signals, some of which are unencoded. Super-Ratt makes copying these easier by offering a continuous range of speeds and automatic storage.

If you are like me and operating takes a backseat to hardware and software tinkering, then you'll be happy to learn that Super-Ratt is meant for the hacker. The programs are written in Applesoft Basic and come in both remarked and compacted versions. This brings us to "Ratt-Soft," an offshoot of Basic that uses the Apple's ampersand (&) command that allows users to define their own functions. Super-Ratt uses almost three dozen ampersand functions, and the manual includes a short description of each one in case you want to write your own software or make changes in the original program. The author of Super-Ratt encourages you to strike out on your own and, accordingly, the manual gives a brief description of the program variable names, reset parameters, and I/O locations. Obviously, anyone who wants to make use of this information should be acquainted with Basic programming and the Apple computer first.

Even the best mousetrap has some nondistinguishing characteristics, as does Super-Ratt. This program, like other software-only RTTY packages, is only as good as your terminal unit and receiver. (The Egbert II RTTY program is a notable exception. There, the software and computer form the TU.) If you have a simple one-chip phase-locked-loop demodulator, then you are going to have trouble when fading and noise move in. Other quirks include the cumbersome way in which the time can be accessed if you have a hardware clock in your Apple; the program requires a manual update command to be typed on every occasion the time is sent, and if you are one of those operators who likes to monitor the status of the transmit and receive buffers, you'll find that the information is available but at the expense of shifting out of receive to glance at it. Finally, the mark/space status indicator is no substitute for a scope display or a good meter indicator when it comes time to tune in a signal.

My most serious reservations about Super-Ratt are the result of its sophistication. As a beginning user, at times I found myself typing the wrong command keys. The result certainly isn't fatal but it can be embarrassing. Hams new to RTTY may be intimidated by the array of commands, and the instructions don't always help — they highlight rather than fully explain features. Similarly, if you are a new Apple owner, it might be a good idea to spend a few weeks trying other, less sophisticated operations with your computer before you start interfacing it to a terminal unit and creating a RTTY program disk.

There are a handful of RTTY programs sold for the Apple computer. What makes Super-Ratt special? One, it offers solid performance for day-to-day operating; two, the radio bulletin board system is as interesting and popular as they come; and three, Super-Ratt is a program you can tinker with and grow into. Universal Software has indeed built a better "Ratt." And I suspect that the well-beaten path to their door will soon be turning into a highway.

Super-Ratt sells for $59.95. For more information, contact *Universal Software, 9 Shields Lane, Ridgefield CT 06877.* Reader Service number 490.

Timothy Daniel N8RK
Oxford OH

DRAKE 9000E COMMUNICATIONS TERMINAL

Within the past two to three years, after a rather lethargic period, there has been a resurgence of interest in amateur and SWL RTTY activity. Primarily, this has been due to the state of the art moving rapidly forward, thus making available video-display-type communications terminals, which, technically at least, far surpass the capabilities of teleprinters and their associated equipment.

This revival has also had the incentive of lowered costs of such terminals, together with the popularity of personal computers that has burst upon us within the last few years. Even the most lowly $89 computer can now transmit and receive RTTY and CW. Electronics has never been a standstill industry, and with the advent of the integrated circuit, it was only a matter of time until computers and ham radio merged to form a single path of two extremely exciting interests.

Actively aiding this explosion of interest in communications, the Drake Company of Miamisburg, Ohio, has recently released the Theta 9000E communications terminal.

To say that this terminal is the ultimate terminal would be incorrect, not because of any lack of features, by any means, but because of the very volatility of electronics design. Nevertheless, the Drake 9000E has so many operating features that some owners will probably never get around to using all of them. Let's look at these capabilities in depth and see how useful they can be to the operator or listener.

Features

The Theta 9000E operates in five distinct modes and numerous sub-modes. Not all of these are related directly to amateur radio or commercial monitoring, for several of these are definitely computer-oriented. This is not to say that this aspect may not also be ultimately used for ham operation. In fact, as FCC regulations permit (and it may be hoped these will continue to be brought to within the state of the art), the 9000E will be extremely useful when used in computer-to-computer communication.

Specifications of the 9000E are shown in Table 1. As a communications terminal, the 9000E will send and receive CW, Baudot (RTTY), and ASCII (RTTY and KCS). The last-named, Kansas City Standard, has some restrictions, which will be mentioned later. As a computer, the 9000E has a full word-processor function, useful for writing articles, letters, etc.

A standard and an enlarged video-display format can be used, as well as a memory capability of 14,000 characters which may be scrolled on-screen. A graphics function with an accessory light pen allows drawings to be produced on screen, which may be saved to a cassette tape recorder (not supplied) or transmitted to another Theta 9000E.

It is possible to use the terminal in full-

Drake Theta 9000E communications terminal (Photo courtesy of R. L. Drake Company).

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73: Amateur Radio's Technical Journal*, Peterborough NH 03458.

duplex mode while using ASCII, and you can also use the unit as an RS-232C terminal at up to 9600 baud. Three frequency shifts are available, and either high-tone or low-tone pairs may be selected. Mark-only or space-only copy can be switched in and out, if required.

The only mandatory external equipment required for terminal operation is a power supply and a video-display monitor.

Additional features will be discussed in greater detail below.

Hardware

Mechanically, the 9000E definitely does *not* look like something kludged up in someone's garage. The appearance is first-class, and the mechanical rigidity is solid. All of the electronics are packaged in an attractively finished satin-black metal case measuring 16¼ inches by 9¾ inches, with the panel sloping from 1¾ inches at the front to 3¾ inches at the back.

The keyboard is standard "QWERTY" in ASCII format. In addition, there is a row of 14 special-purpose dual-function keys along the top of the keyboard. These are dedicated to control functions and are quickly identified as they are colored red with white markings (except one, the RESET key, which is white with black markings). There are numerous other computer-oriented keys on this keyboard, such as ESC (Escape), RETURN, BS (Back Space), etc. Nevertheless, when transmitting Baudot, it will conform to the requirements of FCC Regulations Part 97.69 regarding International Telegraphic Alphabet No. 2.

All of the alpha and numeric keys are colored light gray with white indicia, special control keys are black with white, and function keys are either white with black lettering, or, as in the case of the space bar and shift keys, red and red with white, respectively.

Overall, the keyboard has a very pleasing appearance and a good, definitive touch when the keys are depressed. I found the position of the RETURN key a little far away for my pinky to reach comfortably; it must pass over DELETE on the way. However, this opinion is subjective —nearly every computer now has the ENTER or RETURN key at a slightly different position, and it is a matter of getting used to it. (As will be explained later, there are only a few occasions when it is necessary to use the RETURN key anyway, as full-word wraparound is supported.)

It is necessary to remove the case in order to install two AA-type batteries used for memory retention (good for about one year). This is a simple operation and takes but a moment. LEDs are used to indicate power on and the presence of space and mark signals. Two variable controls, Fine Tuning and Volume, are in a vertical line on the right-hand side of the cabinet.

All connections to the 9000E are made via the rear panel (the internal speaker for the audio monitor faces out from this back panel also). Bringing all of the peripheral cabling out the back is quite satisfactory — the great number of possible connections would otherwise make a rat's nest of cabling. Coaxial cable the size of RG-174 (but not otherwise identified) is supplied for making connections to peripheral equipment, together with sufficient phono connectors. The use of this type of connector, especially for RS-232C connections, is not the best way to go. The parallel printer port has a standard DB-25 connection, which is much more effective. The power cable exits from the back panel, too, and jacks are available for connecting an external oscilloscope for monitoring space and mark tuning, if desired. All FSK and AFSK connection circuits are via high-voltage, high-current optoisolators.

The audio monitor is used for both transmitting and receiving and has its own gain control. Monitoring in Receive can be either the output of the mark signal path or space or the audio output from the agc amplifier prior to the channel filters.

Video-Display Terminal Requirements

The video-display terminal (monitor) may be of any size screen. Drake offers a monitor as an option. The display must be capable of accepting a composite video signal of 1.0 volt p-p at 75 Ohms impedance.

Power-Supply Requirements

A power source of 13.6 volts dc (– 1, + 2 volts) at 1.3 A is required for the 9000E. (Drake also offers a suitable power supply as an option.) An on-off rocker-type switch is on the back panel.

Functional Description (Communications-Oriented)

RTTY. The first mode to be described, and probably the most important in the eyes of many who are presently operating, is RTTY. RTTY is available on the 9000E in a multitude of modes, shifts, and speeds. Possibly the most common mode currently in use on the ham bands is Baudot operation with 170-Hz shift and 45.45 baud (60 wpm). However, all of the shift frequencies and baud rates shown in Table 1 are available by keyboard selection. Of course, all of those shown are not currently authorized by the FCC for amateur operation in the US.

These frequency shifts and transmission rates are available as AFSK or FSK transmissions, depending upon the output that is selected for use with the transmitter. Reception will be at the selected shift/speed, and, although it is possible to receive at a different shift or speed than that transmitted by using a quick keyboard change, this is a highly unlikely possibilty.

It should be noted that the shift frequencies and speeds shown in Table 1 are available in a high-tone or low-tone output. The choice made is largely dependent upon whether you are operating in the HF bands or on VHF.

ASCII. The other primary sub-mode in RTTY operation is the one that is gaining more and more adherents since being authorized by the FCC — ASCII. This mode will be of interest to computer buffs, too, as they may transmit and receive computer programs and operate remote computers with no translation needed from ASCII to Baudot.

As with Baudot, the ASCII shifts, speeds, and high-low tones are available, but because of the complete differences in the codes of Baudot and ASCII, the 9000E has dedicated keys to permit selection upon power-up of either one or the other.

One other aspect of ASCII operation will be of interest: the so-called Kansas City Standard (KCS). This operation may be used for recording on a cassette recorder, so that in effect you have a "tape system" capable of storing text or RTTY pictures for future use.

CW. This is the third mode available for transmitting and receiving with the 9000E. This, too, is selected using a dedicated key. Similar to the Baudot and ASCII modes, the CW mode may be effected with several sub-types of operation. But in the case of CW, these probably are more valuable than in the RTTY mode. For example, you may transmit to the screen and built-in audio monitor any approved CW character. The latter is a "local" mode and is not transmitted (you could do that, too, of course). Also, if you need the practice, you may place the terminal in automatic cipher mode and it will send random five-letter group characters forever, if you would like that. You may also direct these groups to a tape recorder or a printer. Using your hand key, bug, or keyer, you can send manually and have it sound on the speaker and appear on the screen. Be-

1. Code
Morse code (CW), Baudot code (RTTY), and ASCII (RTTY and KCS)

2. Characters
Alphabet, figures, symbols, and special characters

3. Speed
Morse: Receiving 5-50 words/minute (automatic track)
Transmitting 5-50 words/minute (weight 1:3~1:6)
Baudot and ASCII: 45.45, 50, 56.88, 74.2, 100, 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600 baud

4. Input
AF input impedance (CW, RTTY, and ASCII): 500 Ohms
KCS imput impedance: 500 Ohms
TTL level input: common to CW, RTTY, and ASCII
RS-232C input: common to CW, RTTY, and ASCII

5. AF Frequency

Morse: 830 Hz		
RTTY (Baudot, ASCII):	Mark	1275 Hz (low tone, 2125 Hz (high tone)
	Shift	170 Hz, 425 Hz, 850 Hz + fine tuning
KCS:	Mark	2400 Hz
	Space	1200 Hz

6. Output

Keying output:	CW	80 mA, 200 V (optoisolator)
	FSK	80 mA, 200 V (optoisolator)
	Remote	200 mA, 100 V (optoisolator)
	PTT	100 mA, 100 V (positive voltage only)

AFSK output impedance: 500 Ohms (common to CW, RTTY, and ASCII)
RS-232C output: common to CW, RTTY, ASCII

7. AFSK Output Frequency

Morse: 830 Hz		
RTTY (Baudot, ASCII):	Mark	1275 Hz (low tone), 2125 Hz (high tone)
	Shift	170 Hz, 425 Hz, 850 Hz + fine tuning
KCS:	Mark	2400 Hz
	Space	1200 Hz

8. Display Output
Composite video-signal output impedance: 75 Ohms

9. Interface for Printer
Centronics compatible parallel interface

10. Number of Characters Displayed
Screen format (keyboard selectable):
80 characters × 24 lines = 1920 characters
40 characters × 24 lines = 960 characters
Possible number of characters displayed: 14,000 characters
Graphics mode: 80 elements wide × 72 elements high

11. Battery-Back-Up Memory
256 characters × 7 channels

12. Buffer Memory
3120 characters

13. Output Impedance for Oscilloscope
200k Ohms

14. AF Output
150 mW
Output impedance: 8 Ohms

15. Power Supply Requirement
Dc + 12 V, 1.3 A

16. Dimensions
415mm × 245mm × 45mm~78mm

17. Accessories

Instruction manual	1
Pin plug	13
Fuse	1
Coaxial cable	4m
Light pen	1
3P connector	1

Table 1. Specifications for the Theta 9000E terminal.

cause of the acute character-recognition attributes of the 9000E, your sending had better be flawless or nearly so. This will be discussed again later on.

You may also send manually but receive by way of the terminal; technically, you could do the reverse by using the keyboard to transmit and listening and copying manually. You may even do this and use the keyboard for typing what you are hearing and have the screen or printer display your copy.

CW transmitting speeds are preselected, with the initial power-up state being 11 wpm. Nine other speeds may be keyboard-selected: 5, 6, 8, 14, 18, 23, 30, 39, and 50 wpm. Ten steps of weighting may be set, also by keyboard control.

CW reception speeds are automatically tracked. If there is a sudden switch from a higher speed of reception to a lower one, several characters may be dropped until synchronization is achieved.

The speeds shown above are not a fixed factor. A refinement of 1/64th higher or lower than the existing speed is possible by a double-key entry. (Using the 9000E for code practice, you could select a goal of speeding up 1/64th each day.)

Description (Computer-Oriented)

If the preceding modes could be described as "communications," then the next can be called "computer." Nevertheless, these, too, may be used in communications where authorized or by direct wire using a modem.

Word Processor. The word-processor mode operates just as any computer word-processing program would, but it does not have all of the embellishments of some of the more esoteric computer programs or dedicated word-processing terminals. Notwithstanding that statement, it is still quite adequate for letter-writing, small article preparation, lists, logging, etc.

For those hams who may not be familiar with computer operations, word processing is the ability to compose, write (type), delete, modify, and move characters, sentences, and blocks of words on the video display until the material is satisfactorily composed. This is like typing something and then being able to change or correct any of it *before* committing it to the printed page.

The word-processor mode is accessed by pressing two keys simultaneously. The baud rate will be 300, and the AFSK output will be 2400 Hz mark and 1200 Hz space (KCS). Up to three pages of 65 lines are available for preparation purposes, with the video presenting 24 lines of 80 characters. The screen splits vertically in this mode, with the leftmost eight character columns comprising an "operation" area and the next 72 columns allowed for "data" — in this case, this is your text area.

In the word-processing mode, you may connect to a tape recorder as well as a printer. Full cursor control is obtained by using the labeled arrow keys, and the cursor may be moved up to 99 lines in one move (depending upon its location at the moment) by three keystrokes.

A great many other standard word-processing functions are available using similar key motions, such as block text change, line insertion/deletion, left and right margin justification, insert and delete spaces, and numerous others. Even one of the more useful and highly desirable functions found in good commercial word-processing programs is within the capability of the 9000E — character search. "Character" may be a single character or a sequence of characters, known in the computer field as a "string." Merely by typing one letter plus the string being sought, the 9000E will search for and display the string upon locating it. This may take a second or two or a fraction of a second depending upon how far the string may be into the text from the start of the search. When found, the screen will scroll to the line where the string is located and the cursor will stop at the beginning of the line that the string is in. If no such string exists, the screen will display "NO DATA." Once found, the string may be deleted, modified, or moved, using the commands for these functions.

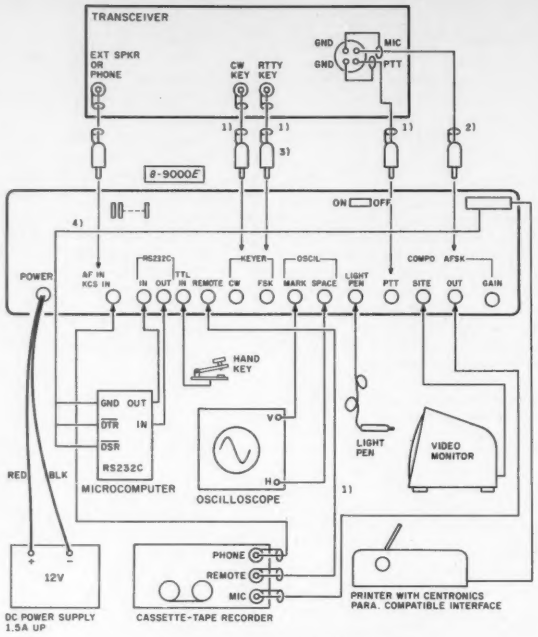


Fig. 1. Peripheral equipment interconnections.

A rather unusual function, and one that is not customarily found in many word-processing programs, is the ability to draw vertical and horizontal lines on the screen or printer. A dual keystroke followed by a numeral will draw either one of these from the cursor position to the extent of the numerical quantity that has been entered. The manual describes this operation as the drawing of horizontal/vertical "lines," and the way it is presented is a little confusing. For instance, if nine horizontal "lines" (manual terminology) are to be drawn, nine hyphens in a row will appear. The manual indicates that each hyphen is a "line," which is not really the concept. Of course, you can draw nine truly individual *broken* horizontal lines by requesting the required number of hyphens for each of the nine lines desired. The same applies to vertical "lines." In this case, the vertical "lines" are colons presented vertically down the screen. Regardless of how this is presented in the manual, the ability to draw lines such as these is an excellent way to quickly lay out tables and charts on the screen and the printer.

The 9000E memory may be used for the retention of repetitive material used in the word-processing mode, the lines mentioned above, or names and addresses, etc., for instance, and these may be accessed as required. The memory function will be described in more detail presently in connection with the other functions.

Graphics. The final major function of the 9000E is the graphics mode. This will be mentioned in this review as a major mode, although in the 9000E manual it is relegated to a category of sub-functions that includes split-screen operation and selective calling.

The graphics mode, however, is not only unusual for a communications terminal to have, but also its output may be transmitted to other Theta 9000E terminals and could be useful for rough schematic drawings or block-diagram transmissions.

Graphics are created using a supplied light pen. Once again, for those not too familiar with computer techniques, a light pen may "read" or "write" data to and from a CRT by touching the light-sensitive tip of the pen to the screen. This is exactly what happens with the 9000E, but using the pen to read characters does not apply with this equipment. Any characters created on the screen may be transmitted to either a tape recorder or another Theta as mentioned.

Initially, in the graphics mode, the screen will display a full grid of small light squares (pixels). To use the light pen, the tip is touched against the display, and, while holding one key down, the pen is moved vertically and horizontally, as required. This creates a pattern of small inverted "U" block characters wherever the pen touches a pixel while the key is depressed. When finished, a single command erases all of the remaining pixels, which leaves the sketch as composed.

Memory

The impressive memory capabilities of the 9000E are sufficiently important to warrant review consideration in some detail. Memory in the RTTY mode is like having a built-in paper-tape capability. In this instance, however, you may modify and store data ready for transmission or other use in an instant, and without the noise of a paper punch.

The memory is available for use in all modes. In fact, some data stored in memory may be applicable and used interchangeably in RTTY *and* CW, for instance. But protocol will dictate actual usage: CW abbreviations have limited use, if any, in a RTTY QSO; on the other hand, words spelled out are seldom used in CW, except for traffic handling when this could be particularly useful. (For traffic handling, you can transmit the "received" screen, too.)

A 3120-character buffer memory may be utilized in split-screen mode on the lower portion of the screen. This is a volatile memory. A Random Access Memory (RAM) capability of 256 characters each in seven different channels is also available. Data is maintained in this area with the batteries mentioned under "Hardware." Data in this area may be changed at any time, and in any channel, without disturbing the contents of other channels. It should also be mentioned that data in the buffer may be changed even while being transmitted, if necessary (before it is keyed, of course).

One memory channel (channel 6) has 16 subsections with space for 16 characters each in it, and another (channel 7) has eight subsections of 32 characters each. Transmission of data in the first five channels (256 characters each) may be repeated up to nine times. Channel 6 with its 16 subsections may "chain" or overwrite into a subsequent channel if the number of characters in one exceeds its limits. Thus it, too, may be utilized for 256 characters if necessary. This channel also may be repeated up to nine times.

The operation of channel 7 is similar; however, subsection 7 of this channel has the "QBF" message written in it ("THE QUICK BROWN FOX..."), and "CW ID FOLLOWS" is in subsection 8, which will also normally contain your call. No repeat function occurs in channel 7. A stored "RYRY" is present, too.

Operator's Manual

Until I began reading the manual, I honestly believed that the 9000E was of US manufacture (not yet having looked at the serial-number plate). Almost immediately it was evident that the manual was written in Japanese-oriented English. Not that this pattern is particularly difficult to understand in this instance, but a few of the sentences and phrases throughout the manual are convoluted to the extent that you may ask, "What does this mean?"

In addition, the manual suffers from a lack of good organization, with a number of explanations either redundant or scattered piecemeal in different parts of the manual. A good English editorial treatment of the manual could cut its volume by a third and at the same time make it far more easy to read and understand.

Physically, the manual is composed of 75 pages of sharp typewriter-font copy; it is very legible, being printed on good quality, coated white paper. Sectional numbering is maintained throughout, although there is a preponderance of section, subsection, paragraph, and item numbering, which becomes quite confusing when looking for a particular subject.

All of this is bound in a stiff cardstock blue cover. Unfortunately, the book is glued along the spine, making it impossible to use it open and flat. (I cut the spine off, punched three holes in it, and bound it in a three-ring binder.)

There is a Table of Contents, but no Index, which would be helpful, inasmuch as the breaking up of information as mentioned above may place important information in more than one location.

One section, "Introduction to All the Function Keys," is a valuable inclusion. All keys, used singly, dually, or triply, are shown as they refer to the various functions they perform together with an ex-

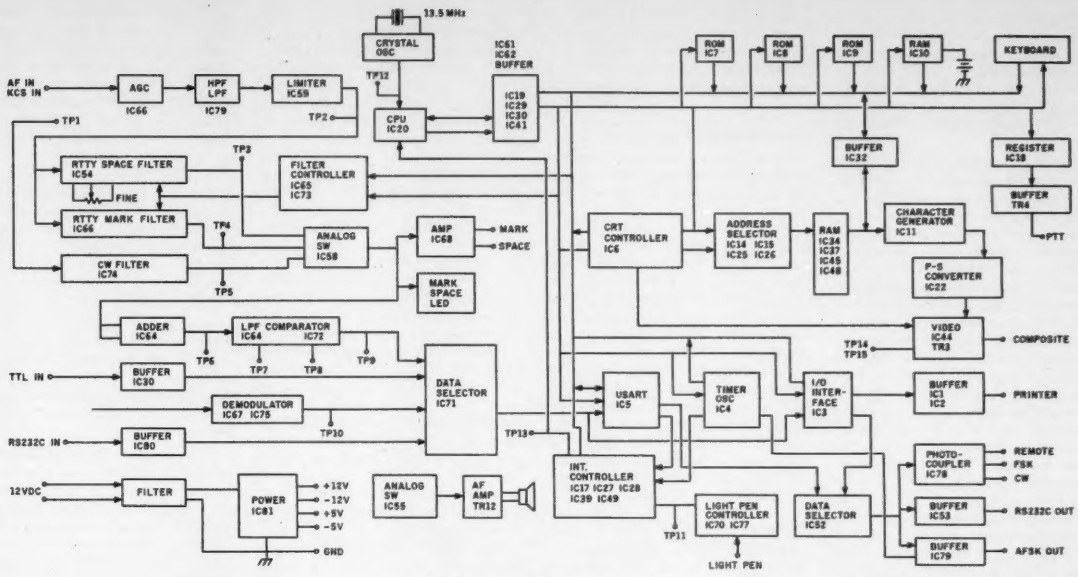


Fig. 2. Drake 9000E block diagram.

planation of exactly what occurs when they are pressed. The keytop identifications, as shown in this section as well as wherever they appear throughout the manual, are uniquely displayed and leave no doubt as to how they are to be used. This lucid system works this way: A keytop drawing is shown as a rectangle. Within it is the letter or word as it appears on the keytop, e.g., "SHIFT." If another key is used immediately afterward as a part of the function, it is shown as well, but with a space between the two. However, if two keys are to be pressed simultaneously, there is no space between the two keytops, just a single line dividing the two rectangles. This is one of the best ways I have seen to describe multi-key operations — and there are many required in computer activities.

There are two photographs in the manual, one of the keyboard (similar to the one shown here, but with callouts) and another of the rear panel of the terminal. Both of these are glossy photographs and were pasted into my copy, which would indicate I received an early copy of the manual (or perhaps that is the way the photos will be provided in all manuals). There are many line drawings explaining how the various screen displays will appear. There is also a good interconnection line drawing, an interconnection drawing for a selcal system, and one for using the 9000E as an RS-232C terminal with an external computer. There are other drawings showing connections to peripheral equipment (printer, recorder, etc.), an input-output circuit drawing, and a block diagram of the entire terminal. There is no schematic, however, and there's a dearth of detailed technical information.

In discussing the latter situation with Drake marketing personnel, I was advised that this was the extent of the information that was available at the present time. This is unfortunate, for although I would probably never attempt to do any serious troubleshooting on this complex unit, I would like to be able to analyze the circuitry. I am sure, too, that prospective owners would like to be able to make specification comparisons. This also raises a question in my mind as to just how Drake proposes to repair these units, under warranty or otherwise, if they have no technical data.

Back to the manual, briefly. Several tables at the back of the manual are useful. One shows the relationship of every key, both in upppercase and lowercase, of each CW, Baudot, and ASCII character and their representation on the monitor screen. Another table shows the CW signal, in dots and dashes, for every applicable key on the terminal. A table of control codes is also included.

Overall, it is a good manual, despite my criticisms. It is amply illustrated, with sometimes more being learned from these line drawings than from the text. Some prior operating experience on the part of the reader is a must in reading it, nevertheless.

Operating the Theta 9000E

Operating the 9000E in any mode is a pleasure. When first turned on, the top line of the video display reads, MODE? You now have a basic choice of selecting any of the available modes of operation simply by pressing one of the dedicated keys. Briefly, here is a typical example of operating supposing you had selected the key labeled MORSE.

Immediately, there is a status display across the lower third of the display. The information provided is MODE (in this instance it will read MODE = CW), TYPE, SENSE, INPUT, PTT, CH = 0, CASE, AUDIO = AGC, CR/LF = OFF, SPEED = 11 WPM, DIDDLE = OFF, and FUNCTION, with each of these indicating the default. It's a wealth of information, and more will be added as you select various functions.

It takes a while to become acquainted with the significant items. I say "significant" because, as the more knowledgeable among the readers will know, all of the function-status items shown above are not required in CW operation. For instance, DIDDLE will be used in RTTY if wanted, but not in CW — that's why it is OFF. The same applies to SENSE. RX = N and TX = N means "Normal," that is, not inverted — another RTTY assignment. It would probably be desirable in the status display if those items not applicable to the mode were not shown.

If you wish, you may now change the screen display from 80 characters of 24 lines to 40 characters of 24 lines, approximately doubling the size of the characters. At the same time, the status display will change to the larger character size and will now require four lines. Whatever is done is purely a matter of preference — many persons have difficulty reading an 80-character screen on a nine-inch monitor, for instance, and will opt for the larger characters. Then, too, some monitors will not accept an 80-character display.

Continuing with this typical CW session, you can now enter information relating to the type of operation to be used. If you will be receiving only, then no further preparation is necessary (assuming your input is audio from the receiver, thus AF in the status line). But if you plan to transmit (or send only to the audio monitor in the terminal) from the keyboard, the default transmitting speed of 11 wpm may need to be changed. One control key followed by one of the numeral keys will provide this change. Key 0 changes the output speed to 5 wpm. The remaining keys move the speed up as 6, 8, 11, 14, 18, 23, 30, 39, and 50 wpm. Also, you can fine-tune the transmitting speed, as has been described before.

The weighting adjustment can be performed within ten limits of 1:3 through 1:6. If you do not wish to enter optional parameters each time you fire up the terminal, you can store them in memory for automatic selection, but of course they may be changed at any time.

You will not change anything for receiving; the 9000E will track CW over the range 5 to 50 wpm. Dots that are less than 20 ms may be regarded as noise. Previous comments regarding the accuracy of the CW for copying apply — there are very few terminals, if any, that will copy rotten CW or what must be termed "non-International Morse." This terminal tends to print what is sent; if it forms a Morse character, it prints; if not, nothing!

Tuning CW is extremely easy. You just tune the receiver on the desired signal until the SPACE LED on the keyboard panel pulses with the signal. At this point, the audio signal is passing through the bandpass filter, which has a center frequency of 830 Hz. Tuning may also be done using the audio-monitor output, but this entails an extra keystroke to set up.

When you are ready to transmit, you may do so by applying whatever system your station requires to do so manually or by merely depressing the PTT key (yes, even on CW or RTTY, Push to Talk). When this is done, depressing any key will immediately start transmission. Pressing a two-key combination returns you to receive.

In CW, standard prosigns operate both in transmit and receive. Barred KN, AR, AS, and VA are available, for instance, and punctuation symbols such as colon, hyphen, right and left parentheses, etc., transmit the International Morse signals for these characters or print their deciphered representation. Barred BT is represented as "=" and barred AR as the "+" symbol, for example.

Initializing in either Baudot or ASCII RTTY mode is the same as for CW but by pressing the appropriate single keys for these modes. When the status display comes up, you enter whatever parameters you will be operating. The default in Baudot will be low-frequency tones, 170-Hz shift, and 45.45-baud operation. Any selection made will apply to both AFSK and FSK operation, which will have been chosen beforehand. As shown in the specifications, the 9000E accommodates both low and high tones. The protocol in ham operation is that the low-frequency shifts are used for HF operation and the high-frequency shifts (e.g., 2125 and 2295 Hz for a 170-Hz shift) are used in VHF operation.

You can change the default to a shift of 425 Hz or 850 Hz in both low- and high-tone groups. If 170 Hz in high-tone shift is needed, then this too must be entered as it is not the default. There is one other shift for KCS, which has mark at 2400 Hz and space at 1200 Hz. This is set from the ASCII mode.

In addition to the many sub-functions that have been mentioned before, you also have several other options designed for RTTY operation: ANTI, which will bring in anti-noise filtering and thus prevent garbage from printing; the optimum line length before carriage return (80, 72, or 64 characters, not to be confused with screen character width); and defeat of the carriage return. The latter action would be desirable if you were transmitting or re-

ceiving RTTY pictures, for instance. Speeds will also be set at this time, keeping in mind the previous comments about approved speeds. (It is extremely interesting to watch a stream of data displaying at 9600 baud, but don't try this on the air if you are operating lower than 50.0 MHz!)

DIDDLE (sometimes called IDLE) has a default of OFF and the function is not too often heard on the ham bands. This is a Letters code continuously transmitted whenever a printing character is not being transmitted, indicating the frequency is being used and the RTTY signal is not just a carrier (slower typists appear to use it to some extent). USO (Unshift on Space) can also be programmed, but this is not a function that can be placed into memory. Its use, too, is infrequent, but it is of great assistance when receiving weak signals. This places the terminal back into Letters case upon receipt of a space signal, thus preventing the printer or display from hanging up in Figures case for more than a few characters. Associated with this, the CASE = statement on the status display will show at all times the Letters or Figures status being received or transmitted at the moment it is occurring, except in ASCII mode. In the latter operation, ASCII will normally be operating as a typewriter would: in lowercase except for capitals and punctuation, with numerals transmitted as lowercase characters. (This does not preclude operating with all capitals in ASCII, however.)

Operation in RTTY is essentially the same as for CW. Depressing one key puts you on the air (or to tape, screen, or printer). You may operate one-on-one so to speak, whereby as soon as you stop transmitting and sign over, you are back to receiving; incidentally, there is not too much dialog-type operation (semi break-in) going on on the ham bands with RTTY. This is unfortunate, because the 9000E is ideally suited for this. As it is, most of the operation we see is of the type whereby one station transmits a long monolog and then waits for the same from the other station. If this is your style, the 9000E is perfectly compatible for this, too.

Splitting the screen facilitates this technique. A keystroke places all received data in the top nine lines of the screen. The transmitting screen is eight lines below this, with a blank line between. Following another blank line, the status display appears (two lines in 80-character mode) and remains always visible. Below the status display, there are three lines reserved for buffer memory. With this arrangement, while the other station is sending CQ, for example, you can be typing your call into the buffer and entering the automatic CW ID FOLLOWS command. As soon as the station signs, pressing just two keys transmits your buffer data. As it dumps out of the buffer, it will disappear off to the left of the screen, letter by letter, to reappear in the transmitting area of the screen as it is transmitted. You now have a record of the receiving and transmitting screens if you are making hard copy at the same time.

Nothing could be easier, and there is a great advantage in being able to compose your replies while the other station transmits, with your transmission streaming out at the full speed at which you are operating. Until the buffer is emptied, no one will know that you can type only five words per minute. Most operators will probably be able to keep up with the buffer at 60 wpm, especially if they have a few lines started before the other station signs over. Higher speeds will tax the skill of even the fastest operator.

CW operation can be just as much fun, with the restriction already noted about good CW being needed. No problems were noted in 100% copy at 35 wpm from W1AW taped bulletins and a number of commercial press stations at speeds of 20 to 40 wpm.

Selective Calling (Selcal)

Selcal can be used in any mode for receiving and transmitting and is one of the easiest to prepare for operation with this terminal.

Your identifying characters are stored in one of the memory channels prior to operation, and selcal is left activated. Upon receiving the same characters as stored in memory, the data being sent will be stored in a memory block and printed or displayed if activated. It may also be printed later, of course.

If you have stored data waiting for transmission, receipt of your END OF TEXT data, also previously prepared, will automatically transmit your data from memory. Although most applications of selcal operation will be in RTTY operation, as noted above it may be used in any mode, which includes CW.

Receiving Commercial Stations

No difficulty whatsoever was experienced in receiving any RTTY appearing on the ham bands where everyone generally was using 170-Hz shift and 60, 75, and 100 wpm. ASCII is being used to some extent, but it is necessary that its characteristics be recognized in order to place the terminal in ASCII mode for reception, even though you can switch from Baudot to ASCII at the touch of a key.

Tuning commercial RTTY stations required considerable patience in most cases. This is due to the fact that although a multitude of stations are scattered throughout the HF and LF spectrum, they are using odd frequency shifts, inverted signals, and numerous transmission speeds, so that it becomes a problem to immediately decipher the mode, speed, etc. Some will never be attainable and others, even when they are copied, are of little interest unless you are into cryptography.

There are tuning aids on the 9000E that make it easier to copy such stations, though. By carefully tuning so that you obtain both mark and space indications on the LEDs on the panel and then using the fine-tuning control, it is possible to establish the shift width. Of course, this may mean going through the operation for 170-, 425-, and 850-Hz positions. You may then need to determine the speed of transmission to have copy appear on the display. And in each situation you may need to determine whether or not the signal is inverted.

All things considered, tuning commercial stations can be a challenge. A good commercial station list such as published by Universal Electronics, Inc., in Reynoldsburg, Ohio, is invaluable in locating and tuning these stations. These guides give the transmission frequency, shift, speed, inversion, and type of transmission for hundreds of stations.

Problems and Criticisms

There was one unexplained action that occurred under certain circumstances but which cannot properly be considered a problem. This was when an attempt was made to perform a function that the terminal was not programmed to do at the moment. For instance, when a tone shift was attempted but a non-applicable secondary key was pressed, the speaker in the audio monitor chirped briefly. This could be some sort of alerting signal, but if it was, it was not mentioned in the manual. The R. L. Drake Company had no explanation for this either, except to agree that it might be a warning signal.

One other possible problem that appeared to be originating in the terminal was a slight non-linearity in the display about mid-screen. This gave the effect of sloping letters on a line. This occurred with three different monitors and could be a voltage-regulation problem. This corrected itself after about ten minutes of operation.

The connectors that were described earlier could eventually cause intermittent contact problems. The use of BNC-type connectors would probably increase the end-user cost by about ten dollars, but this would be in keeping with the other professional aspects of this terminal.

When the 9000E was connected to a Yaesu FRG-7700 receiver which used a wire antenna directly to the antenna terminal, the RFI from the 9000E microprocessor completely obliterated all signal reception — this notwithstanding statements of minimal radiation problems. Connecting the receiver via coaxial cable to another antenna (vertical) located 40 feet away from the terminal eliminated any vestige of RFI.

Some improvements could be made to the Operator's Manual. Additional technical information, and *at least* a schematic, would be an asset.

Summary Evaluation

As a multi-function dedicated communications terminal, the 9000E meets all of the requirements. It is mechanically and electrically well-constructed and has a pleasing appearance. All controls are ergonomically correct, and the keyboard has excellent tactile response.

Although it was not possible to evaluate filtering bandwidths without laboratory specifications, the filtering appeared adequate under all situations. The crystal-controlled AFSK signal appeared to be well within tolerance, but no specification was given for this either.

From an operation viewpoint—and this could be the proof of the pudding — the 9000E came up to all expectations and beyond. Every function operated as specified and operating ease was exemplary.

This is an excellent communications terminal; beginners, experienced operators, and anyone in between will feel very comfortable with it. I can recommend it highly for anyone looking for an outstanding piece of equipment, one which not only allows full on-the-air capabilities, but also is excellent for line communications and computer and word-processing operations.

For more information on the Theta 9000E communications terminal, contact the *R. L. Drake Company, 540 Richard Street, Miamisburg OH 45342.*

A. A. Wicks W6SWZ
Agoura CA

References

The Radio Amateur's Handbook, American Radio Relay League, 1983.
The FCC Rule Book, American Radio Relay League, 1983.

HEATHKIT ULTRAPRO CW KEYBOARD

Have you ever felt that your CW sending could sound better? Have you felt perhaps, too, that to improve from where you are would take more time and effort than you would like to invest? You need to consider the new Heathkit Ultrapro CW keyboard (HD-8999).

Hams more familiar with a Stillson wrench than a keyboard soon become proficient at keyboard sending, with the promise of perfection which a keyboard offers. If you're ahead of the Stillson wrench group and know where the keys are on a typewriter or computer, with the Ultrapro, you too can be on your way to a dramatic improvement in your keying.

Buffer Memory

The Ultrapro is a compact gem of a keyboard that tends to turn the operator into the pro that the name implies. The crucial element in the keyboard for accomplishing this perfection is its buffer memory. The Ultrapro has a 64-character buffer, which is ample for high-speed sending.

Given my typing ability, a buffer of more than five to ten characters is gilding the lily at 45 to 50 wpm. What the buffer does is accumulate any characters I can type into it faster than I have set the keyboard to send. This affects my sending in three ways.

First, Ultrapro will stack those characters next to each other for perfect spacing of letters and, with the stroke of the space bar, the spacing of words. This action eliminates the little imperfections in timing that occur even with rhythmic typing on a keyboard without a buffer. If I have a momentary distraction, again, it won't show up in the middle of a word or sentence as a gap. Such gaps can be even more distracting to the person attempting to copy high-speed code.

A second effect is the minimization of keying errors. If I realize I have punched the wrong key, I can simply backspace one space ("delete" on the Ultrapro) and retype. The backspace both erases the error and resets the position in the word for the right letter. If my error is three letters back in the word, I backspace three and retype all three. Because I'm obliged to retype anything following the errors, I don't have to count forward to be able to start where I left off.

If I'm not sure of the entire word, or of even two or three words, I can shift/delete and, with each punch of delete, the last word or part of a word will drop out, leaving the space after the remaining word intact. Then, I merely continue to add to the buffer by typing in the correct words.

The third thing the buffer gives me is time to think of what I'm going to send next without having to throw in some potentially annoying (punctuation) dashes. The overall effect of the buffer, then, is to smooth the test into what we used to call tape-machine perfection.

In addition to the rapid correcting which the buffer memory affords, the two-key roll-over feature also facilitates fast typing. Simply stated, if I punch a second key before I let up on the previous one, the letters are entered in order as long as I let up on the first key before the second. Without this feature, neither might be entered or, possibly, only the first letter.

Commands also can be stored in the buffer so that, while typing ahead, I can tell the board to speed up ten words a minute right after I say I will. Weight and spacing changes may be accomplished in the same manner. The board will then type on at the previous setting until the buffer empties to the command that I gave. This can be a slight disadvantage if I decide that I want the change right away during a transmission. If I have any text in the buffer, I must wait until that text is transmitted before my command is fulfilled, unless I want to dump the buffer contents with the stop key, make a command, then retype what was dumped. This shows up as a short hesitation in my transmission.

Hold Function

A distinctively larger hold key freezes the emptying of the buffer into the transmitter. This feature is good for a couple of reasons. If I'm operating QSK and think I hear a breaker, an interfering signal, or the person I'm talking with, I punch hold. If it's nothing that requires a response, I punch the hold key again and the buffer continues to transmit from where it left off. If a response is required, I punch another larger command key, the stop key. Then I can begin filling the buffer memory with my response if the signal from the other station continues. If the transmission is short, or stops, I punch the hold key a second time to re-enable the transmission of whatever I now type into the buffer.

Hold is also useful when the other station is about to turn it back to me. I punch hold. This condition is displayed on the LED digit display until I punch hold a second time. I then insert perhaps the other station's call and add my ID from the 495-character programmable memory. I'll write more about that later. Then I can type "R R" and start typing my reply into the buffer. As quickly as the other person signs "K", I hit hold the second time and continue to type into the buffer while it starts transmitting for me. This feature gives me more of that time we were talking about to think, type, make errors, and correct them.

Programmable Memory

The second type of memory in this board is intended to be filled with parts of transmissions that are recurrent in QSOs. There is available in this memory 496 characters worth of space. This memory is addressable at ten points by punching shift and then one of the digits from zero through nine. I don't have to cramp each message into a space 49.5 characters in length, either. That's because this memory has what is called soft partitioning, which enables me to mix long and short messages up to the full utilization of character spaces. I don't even have to enter them in numerical order.

Filling or changing any particular segment is easy, too. I punch set, the number of the compartment, and load. When I finish loading, I punch stop. This stops further entry into the programmable memory and enables the board for immediate sending. To delete a compartment to make more space available, I hit set, the number of the memory I'm sacrificing, load, and then stop. Each of these messages can be protected from the above by a protect command with the number of the compartment.

Inserting the command into the buffer memory to read one of these segments in the programmable memory takes up only one character of space in the buffer. This maximizes its available space. On the other hand, commanding a speed, weight, or spacing change will take up three or four spaces in the buffer.

Contesting

For the contester, aside from the board's handy programmable memory described above, it will send serial numbers — one each time you command its transmission. If you need to repeat a serial number in a QSO without the number's increasing, you command the previous serial number as many times as you need it. While you are using this feature, the serial number is displayed continuously on the LED digit display instead of the transmitting speed, which is usually displayed.

The LED digit display is effective in providing the status information the operator needs. A punch of the weight or spacing keys results in a brief display of the parameter, then a return to the wpm value. Loading any of the programmable memories results in the display of a number anywhere from 495 to zero, depending on the remaining space available in these memories. Eight colored bars, five green, two yellow, and one red, denote the consumption of spaces in the 64-character buffer memory, eight letters at a time. During the time that the buffer memory is referring to one of the programmable memories doing a transmission, a small green dot on the LED display signals this to the operator.

An interesting feature of the circuit is its ability to evaluate itself. A flick of the reset switch on the back of the board runs the microprocessor and integrated-circuit diagnostic tests. If all is well, the buffer-status bars will light briefly, and the speed will set and indicate at 20 wpm on the LED digit display. If one of the ICs or the microprocessor is faulty, the circuit component number (e.g., U-2) will be displayed. This feature could take a lot of guesswork out of troubleshooting the keyboard.

Memory of the sending parameters as well as of the programmed material is preserved with minimal current from a battery if the unit is disconnected from its power source. The unit will operate from a range of 7.5 to 11 V ac or 11 to 16 V dc of either polarity.

Code Practice

The code-practice mode offers several useful features to those so inclined. In addition to the usual, some of these features are: (1) selection of type or types of characters on which you wish to concentrate; (2) selection of desired speed, spacing, and weight; and (3) selection of copy mode, using which you must press the correct key after hearing the character before the board will give you the next one. The code-practice mode utilizes random-length and five-character-length groups, not words. My feeling is that this mode might be useful to the early learners of CW to whom the owner of the keyboard might like to be of assistance. I can't recommend staying long with copying random groups to the person interested in learning code at higher speeds.

The Ultrapro keyboard is light (shipping weight 7 lbs.) and stable on a desktop or held on the lap. The keytops are slightly sculpted and the action is without wobble, giving touch and sound feedback that is not obtrusive. A shift/tone command will add level-adjustable sidetone. The key spacing approximates that of my electric typewriter and feels optimal to me. The feel of the board is one of an electromechanical device designed for long, trouble-free service.

Conclusion

As if all the foregoing features weren't enough to commend this new Heathkit, the price for the kit seems quite reasonable: $249.95. And if those features don't quite qualify you sending for Ultrapro status, sprinkle it with the exclamation point, parentheses, semicolon, and colon — these should heighten the color of your QSOs (I've been too fainthearted to use them)! I recommend this kit to anyone who is interested in making a significant improvement in his sending, whether he or she communicates best at 5 wpm, 99 wpm, or somewhere in between.

For more information about the HD-8999 CW keyboard, contact *Heath Company, Benton Harbor MI 49022*. Reader Service number 489.

David Learned W8DFI
Benton Harbor MI

EGBERT II RTTY PROGRAM

Most of the gear I review comes carefully packed in one or more large cardboard cartons. The Egbert II RTTY program was an exception. It arrived in a plain, large-size manila envelope. But Egbert II's inauspicious size and packing material are certainly made up for by its features. Simply put, Egbert II offers all that you need to turn your Apple computer into a RTTY terminal. (Well, not quite all. . . you will need some cables to go between the rig and computer, but that's it.) No terminal unit, no interface card, no extra demodulator circuits. It is all right there on one floppy diskette.

To use the Egbert package, a 48K Apple II, II+, or IIE with one disk drive and Applesoft Basic is required. A printer is optional. If you are a Franklin Ace 100 or Ace 1000 owner, then you must provide some sort of modulator and demodulator since the Egbert program typically utilizes the Apple's cassette interface not found on Franklin computers. Also available under the Egbert name is a CW transmit-receive program for the Apple and a program for transferring Applesoft, Binary, and Integer disk files. This review deals only with the RTTY portion of the package.

The software comes on a single 13-sector copy-protected disk with the user's callsign already embedded. Getting on the air is very simple. First one must create a 16-sector message disk and hook up cables to the receiver audio output, transmitter mike input, and, if desired, the push-to-talk line. The only interface circuitry that may be needed is a 10k-Ohm pot for adjusting the mike drive level and a transistor switch to work between the Apple's TTL level T/R and your rig's push-to-talk line.

It takes about 30 seconds to load the software and insert a message disk. Each initialization step is menu-driven and can be passed through quickly to reach the default mode of 60-wpm RTTY with a standard 170-Hz shift. Or you can enter in your own parameters: Baudot at 60, 67, 75, and 100 wpm, ASCII at 110 baud, any desired mark-space combination, and tone reversal to invert the mark and space frequencies.

The final step before operation is setting the receive frequency. High-resolution graphics are used to display the relationship between the software-driven filtering and the actual mark-space frequencies. You may tune in a signal by adjusting the receiver until the display lines up or by shifting the computer filtering via one of the Apple's arrow keys. With tuning complete, you press RETURN and start receiving. During reception, the graphics are replaced by two flashing stars, allowing you to make minor adjustments in the tuning.

Egbert II offers split-screen operation; received data is displayed on the upper portion of the screen while the bottom three lines are devoted to a type-ahead buffer for your response. If the op on the other end is long-winded, then you might want to use the receive buffer. This saves the received text to memory while it is being displayed. A separate set of commands saves the buffer to disk. Viewing the data is done through the Print Buffer option and can be done via the screen or a printer. Another option is the real-time print option where incoming data is both displayed on the screen and printed out. Although I didn't test this feature, the printer program can accommodate a Votrax speech synthesizer so that words are spoken as they are received.

Transmit features include the type-ahead buffer, a quick break that allows your reply without disturbing the transmit buffer, and automatic CW ID at the end of each transmission. If you are using a message disk, then it will take only two keystrokes to transmit any one of nine canned messages. Each message has an independent length, with a total of 4800 characters allowed for the group. Another help is the inverse display for every 65th character typed. This is handy when working a station with a mechanical teletype machine, indicating that it is time to insert a carriage return.

In addition to normal transmit and receive operation, the Egbert II program offers limited mailbox capability. The computer operates unattended, saving incoming messages to memory and then to disk when the memory is filled. Two options are available: You may store all incoming messages on a particular frequency or just those that are preceded by a special recognition code. Unlike some of the more sophisticated mailbox systems, the Egbert II program is limited to receive-only operation.

The hardware-free approach of Egbert II warrants a closer look. At the heart of the system, you'll find the Apple's seldom-used cassette I/O and some unique software. The cassette input circuitry is merely a level detector, converting the incoming sine wave into a square wave. The Egbert II software does the rest of the job, measuring the frequency of the signal and determining if it is a mark or space.

This approach is not without drawbacks. Signals must be strong and in the clear. Remember, there is no filter to prevent a signal adjacent to the one you want from being read by the Apple. In practice, I found the Egbert II hardwareless design to work quite well and was able to copy the majority of the stations I heard. Judicious use of the rig's (a TS-830) filters was a great help. If your receiver is lacking in this department, then I recommend using a tunable audio filter between it and the Apple.

For serious HF operation, you may want to use a terminal unit. The Egbert program accommodates this by using the Apple game port as an alternative input. The TU must have TTL-level outputs for the received mark and space signals and be compatible with a TTL signal for transmit.

The high-resolution tuning display is a nice touch, but I usually dispensed with it and relied on the simpler two-star tuning aid. With a bit of practice, I was able to tune in a signal in just a few seconds. The fancy tuning display needn't be forgotten, though; the instruction manual suggests that it can also be used as a graphical frequency counter.

My only complaints center on the Egbert II transmit operation. The type-ahead buffer has a backspace feature that is handy for making corrections, but unfortunately there is no cursor to indicate where a correction will take place, making it easy to get lost. A second drawback is the way in which the type-ahead buffer disappears every time you switch to transmit, even if it is only for a quick break. The information is still in memory ready for the next transmission, but there is no way to find what it is without going back to transmit.

A seasoned RTTY operator may find the Egbert II software to be too simple for day-to-day use. However, I feel that the lack of bells and whistles makes the program ideal for beginners. All the necessary commands are displayed on the screen and you can become an expert in a half hour or less, including the time it takes to interface your Apple to a rig. Sure, the software-driven terminal unit won't equal the performance of a dedicated circuit, but you just might be surprised at how

well it does work. One thing's certain: Hams that own an Apple won't find a more painless or less expensive way to try their hand at RTTY.

The RTTY portion of this program is available for $39.95. For more information, contact the *W. H. Nail Co., 275 Lodgeview Drive, Oroville CA 95965.* Reader Service number 486.

Timothy Daniel N8RK
Oxford OH

RTTY89 RADIOTELETYPE COMMUNICATIONS PROCESSOR FROM COMMSOFT

As digital communications slowly but surely revolutionizes amateur radio, many firms have taken a stab at producing computerized RTTY programs. Few companies have accomplished this task more skillfully than Commsoft, makers of RTTY89, a radioteletype program for the Heath H89 All-in-One microcomputer. RTTY89 was written by Howard L. Nurse W6LLO and is designed to make maximum use of the special function keys and 80-column video display capabilities of the H89. This combination of computer and software, along with the best instruction manual in the business, comprises a truly outstanding RTTY system.

Specifications

In the simplest terms, an H89 computer running the RTTY89 program is merely a solid-state substitute for a mechanical teleprinter. But that's only the tip of the iceberg. Unlike any mechanical unit I know of, RTTY89 allows you to switch between any of four Baudot and three ASCII speeds at the push of a button.

In common with all of the better computer RTTY programs, RTTY89 features a split-screen display. The upper portion of the video screen shows the incoming message, while you simultaneously use the lower portion to compose your response. Your message is stored in what Commsoft calls the "pretype buffer" until you press two keys to begin transmitting. Both incoming and outgoing data can be automatically sent to a printer or floppy disk for a permanent record of your RTTY contacts.

A number of permanent messages are stored in the program and may be called up for transmission at any time. These include a "CQ" with your call inserted in the appropriate spot; a line of "RYRYRY..." or its ASCII equivalent, "U*U*U*...", for testing and tuning; a special preamble for the start of your transmission featuring a CW ID, time, and date; and a similar closing for the end of your messages. In addition, you can create three short, custom messages of up to 70 characters each. Both the permanent and user-created messages may be called up for transmission with a single keystroke. Longer messages of your own design, such as brag tapes, can be created at your leisure using a word processor and stored on a floppy disk. Then they can be recalled from disk during RTTY operation and inserted into your outgoing message.

Among the other outstanding features of RTTY89: no loss of received information when loading text from disk; the ability to send messages with justified right margins and distinctly customized left margins; the option to repeat the previous transmission; editing of the last letter, word, or line in the pretype buffer; automatic activation of transmitter push-to-talk when sending; automatic CW ID at an interval you select; and word wrap-around at the end of a line (a word is never split in two).

The Hookup

The RTTY89 program uses the RS-232C serial input/output port of the H89 to communicate with the outside world. In this case, the "outside world" is a RTTY terminal unit (TU) connected to an amateur transceiver. A cable is run between the RS-232C connector on the rear of the computer and the TU. The TU, in turn, is connected to the mike socket and the headphone jack of the transceiver.

In my shack, the terminal unit is the popular Flesher TU-170. Like a number of other TUs, the 170 does not have an RS-232C interface as standard equipment. Fortunately, the Commsoft instruction manual contains a schematic for a simple RS-232C circuit which can be built from Radio Shack parts and added to an existing TU. I did this with my TU-170, and it worked perfectly. If your TU has RS-232C capability, so much the better.

On the Air

Once the wires are connected and RTTY89 is initialized with the time of day, your callsign, and other pertinent information, it's time to tune in some RTTY. In my case, I simply tuned the rig to 40 meters and Bingo! Beautiful RTTY printouts began marching across the video display of my H89 computer. I was in business!

After assuring myself that the receive portion of the system was working properly, it was time to try transmitting. After all, RTTY reception is only as good as your receiver and TU; it's on transmit that RTTY89 would really shine.

And shine it did. I found a WA4 station calling CQ and carefully tuned him in. As he called, I composed a response on the lower portion of the split screen. Hesitantly at first, then with more confidence, I built up my message in the pretype buffer. First, I hit the computer's Blue function key to enter the preamble (CW ID, RTTY ID, time, date), then a control-V let me enter his callsign, along with my call, name, and QTH. Pressing the Red function key twice repeated this information two more times. The White key entered a closing, with a CW ID. I then entered control-R to put the system back into receive after the transmission.

Remember, all of this was done while the WA4 was sending his CQ. RTTY89 stored my whole response in its pretype buffer while never missing a bit of the WA4's message. Soon, the CQer completed his call. To send my entire response, I merely pressed control-T, then sat back to watch my message being sent out by the computer, complete with CW IDs in the right places.

This business of function keys and control keys sounds pretty complex, but it's amazingly straightforward in practice. For starters, Commsoft's manual does a terrific job of explaining each command. Also, the most often used commands are mostly single keystrokes or easily remembered (control-T for transmit, control-R for receive). Finally, RTTY89 includes a compact prompt card to be posted at the operating position. The card neatly summarizes all 46 (!) commands and gives brief examples of typical operating procedures—extremely helpful.

Summary

I've had the opportunity to use seven different computer RTTY systems, and in one way or another, many of them have proven awkward to use. Some are poorly conceived from the start. Others are badly documented, so that only a RTTY expert can puzzle out how to make them work. Some otherwise fine products have been ruined by poor instructions.

RTTY89 stands out because it works smoothly and efficiently with a minimum of fuss. It is superbly designed and documented and more easily understood than systems with half the number of commands. The ease with which complex messages can be built up with a minimum of keystrokes is remarkable and allows even slow typists like me to have great fun on RTTY. The designers of programs for today's low-cost computers should take a lesson from RTTY89. It's too bad there aren't more H89s around.

The Commsoft RTTY89 program sells for $34.95 from *Commsoft, 665 Maybell Avenue, Palo Alto CA 94306.* Reader Service number 488.

Jeff DeTray WB8BTH
73 Staff

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

SPRATLY ISLANDS—DX DISASTER

The widely-scattered reefs and rocks of the Spratly Island group in the South China Sea have long been one of the oddballs in the DXCC "Countries" list. Claimed by every country in the region, and (until recently) uninhabited, the 100 or so tiny islands offer a severe challenge to the determined DXpeditioner. And that challenge proved too much for two German amateurs who died in an April, 1983, attempt to operate from Spratly.

What *really* happened to the group led by Baldur Drobnica DJ6SI? Baldur has put the rumors to rest with a cassette tape, relayed through Ralph Hirsch K1RH, and translated with the assistance of the language department of Southern Connecticut State University.

But first let's review the amateur radio history of the Spratly group. The infamous Don Miller W9WNV claims the first operation from Spratly in the mid-60s. Don used the call 1S9NWN, the first use of a prefix beginning with 1, which is not issued by the International Telecommunications Union (ITU). Don claimed operation from the largest island of the group, Spratly.

The next Spratly operation was engineered by Don Reihboff K7ZZ, from Vietnam, in 1973. Don commandeered W4EBG, N5TP, and others to mount a major DXpedition to Spratly Island, well documented by Don's ever-present Super-8 movie camera.

Spratly worked its way up the Most Wanted list until 1979, when K1MM and K4SMX boarded VK2BJL's yacht for another attempt at the island group. Their goal was Amboyna Cay (about 100 miles southeast of Spratly Island), as Spratly was firmly in the grasp of trigger-happy Vietcong. Amboyna Cay was also inhabited by unfriendly natives, and the group retired abruptly when gunfire erupted from Amboyna. They moved to a tiny sandbar, Barque Canada Reef, a few miles to the northwest. Several less-courageous (more reasonable?) members of the trip stayed in Brunei while the three intrepid DXpeditioners operated from an unadministered island too close to Malaysia to count as a separate DX country under DXCC rules.

Photo A. Phil Weaver VS6CT kept the amateur radio world informed of the progress of the search for Baldur's ill-fated Spratly DXpedition. Phil provided additional details at the Visalia International DX Convention this past spring.

Many other DXpeditioners who watched Spratly move up the Most Wanted list investigated the possibility of another trip to the region, but maritime warnings, the advice of the US Department of State, and the experience of the last DXpedition to the area discouraged most amateurs.

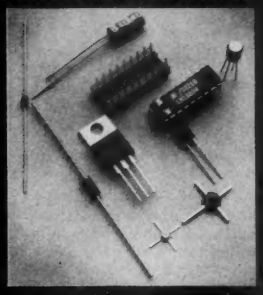
Which bring us to DJ6SI's attempt. Forty-eight-year-old Baldur Drobnica originally aimed for a DXpedition to St. Peter and Paul Rocks (PY0) off the coast of Brazil, but a recent DXpedition had knocked PY0 out of the top 25 of the Most Wanted list. Of the other DXCC countries on that top 25 list, most had political rather than logistical reasons for lack of amateur radio activity (see this column, December, 1982). Heard Island was well covered (see this column, August, 1983), and the season was wrong for an assault on Bouvet, 3Y1. So Baldur narrowed his choice to Clipperton (FO0) and Spratly. Clipperton required a long trip through Tahiti, as well as special permission,

KCS
ELECTRONICS CORPORATION

SEMICONDUCTOR PARTS & PRODUCTS

FACTORY PRIME DEVICES INCLUDE:

- Capacitors *all types & styles*
- Chokes & Coils
- Connectors
- Digital & Linear IC's
- Hardware & Accessories
- IC Sockets
- Memory
- Microwave Semiconductors
- Resistors *fixed & variable*
- Transformers
- Transistors *& MORE!*



MANUFACTURERS SUCH AS: Motorola, National, NEC, J.W. Miller, Texas Instruments and more!

WE STOCK & SUPPLY DEVICES FOR: OEM's, Distributors, Hobbiests, Magazine Projects, Engineers, Schools, Technicians & You!

Call or Write for Quantity Pricing and FREE Catalog.

P.O. Box 33205
Phoenix, AZ 85067 **(602) 274-2885**

230

MICROWAVE TV ANTENNA SYSTEMS

Freq. 2.1 to 2.6 GHz • 34 db Gain +

TWO YEAR WARRANTY
PARTS & LABOR

COMPLETE SYSTEMS (as Pictured)
Commercial 40" Rod Style $ 89.95
Parabolic 20" Dish Style $ 79.95

COMPONENTS
Down Converters (both types) $ 34.95
Power Supplies (12V to 16V) $ 24.95
Data Info (Plans) $ 9.95

CALL OR WRITE FOR KITS. PARTS. INDIVIDUAL COMPONENTS

We Repair All Types Down Converters & Power Supplies

Phillips-Tech Electronics
P.O. Box 34772
Phoenix, AZ 85067
(602) 265-8255

246

Special Quantity Pricing
Dealers Wanted

MasterCard VISA COD'S

ALL NEW H.F. 10/160 METER SOLID STATE P.L.L. TRANSCEIVER

Model 10/160 M

USB-LSB	CW-W CW-N
4 Memories	200 W. PEP (160M-12M)
3 Way Auto-Scan	100 W. PEP (10M)
Includes New Bands	Built-in Power Supply
3-Step Tuning Speed	AC-120 VAC
IF Tune ± 1 KHZ	DC-13.8 V -Ground
Built-in Dual VFO	External ALC & Relay
Narrow CW filter optional	RTTY, FAX, ASCII

N.C.G. CO.
NCG

Mfg. Sug. Amateur price
$1,059.00

NOW ONLY $949.50

JUST SLIGHTLY AHEAD

1275 N. GROVE ST.
ANAHEIM, CA 92806
Cable: NATCOLGLZ

TO ORDER OR DLR INFO. CALL
(714) 630-4541

254

NOTE: Price, Specifications subject to change without notice and obligation

HAMEG OSCILLOSCOPE

- 20 MHz Dual Trace
- Built-in Component Tester
- X-Y Operation (1:1 Ratio)
- 2 × 20 MHz, Max. 2 mV/cm
- Timebase 40 ns – 0.2 s/cm
- Trigger Bandwidth 30 Mhz

133

Rivendell Assoc.

RFD-5 DERRY, N.H. 03038 WARNER HILL (603) 434-5371

BUY FACTORY DIRECT & SAVE!!! DEALERS & DISTRIBUTORS

THE ONE STOP SOURCE FOR:
*COAXIAL CABLE—RG-8/U, 213, 214 ETC.
*MULTI CONDUCTOR CABLE—SHIELDED & UNSHIELDED
*ROTOR CABLE—4, 5 & 8 CONDUCTOR ETC.
*CONNECTORS—TYPE N, UHF, BNC, ADAPTERS ETC.

WRITE FOR COMPLETE CATALOG OR CALL COLLECT FOR THE MOST COMPETITIVE PRICES.

12

cz labs
P.O. Box 95-55 Railroad Ave.
Garnerville, New York 10923
(914) 947-1554-1555

See List of Advertisers on page 114

since a previous DXpedition had to be rescued from their Pacific reef. So Baldur chose Spratly.

Baldur first contacted a fellow West German in Brunei to locate a boat to sail to one of the Spratly islands. Despite the close proximity to Spratly (or perhaps because of it?), he was unable to locate a boat and crew for the DXpedition. So Baldur turned to Singapore, a few hundred miles further away. An ad in a sailing magazine led to negotiations with the skipper of *Sidharta*, a 50-foot catamaran, and the trip to Spratly was on!

Warren Gough 9V1VC provided invaluable local assistance, especially in locating the generators, fuel, etc., needed for the DXpedition. This help reduced the time the West German DXpeditioners had to spend in Singapore to a mere two days. On March 31, four amateurs left Cologne for Singapore. After locating a couple of 5.5-meter aluminum poles for antenna masts, the amateurs and crew set sail on April 3 from Singapore harbor.

On board the yacht were Baldur, Norbert Willand DF6FK, Gero Band DJ3NG, and Diethelm Mueller DJ4EI, along with the captain, Peter Marx, and his wife Jenny Toh Swee Neo. After dodging shoals leaving Singapore harbor, the group headed for the Natuna Islands, halfway to Spratly. Their 5-knot speed was putting the group behind schedule, and they still wanted to operate for five full days from Spratly, so they changed their plans to end their sail at Brunei.

As they reached the open water past Natuna, heavy seas forced a slight change in course from 65° to 75°, so they sailed into the Spratly group somewhat east of their intended course toward Barque Canada Reef. They spotted Amboyna Cay, which was covered with military structures and other buildings, but no people, as far as they could tell. But as they changed their course from Amboyna to Barque Canada Reef, about 30–40 kms away, gunfire erupted from Amboyna.

The yacht was about a mile or so from Amboyna, and clearly sailing *away*. Pat N0ZO/DU2 was in radio contact with the yacht, and other stations were undoubtably listening in to the progress of the DXpedition. The first round from Amboyna fell short—the proverbial "warning shot"? The *Sidharta* sailed as fast as possible away from Amboyna, but the next shot hit the yacht, wounding captain Peter Marx in the chest. The group was fighting to get out of range of the gunfire when a third round hit 120 liters of gasoline stored on board. Diethelm Mueller DJ4EI, who was standing next to the gasoline when it exploded, was never seen again. He couldn't swim.

Photo B. Dr. San Hutson K5YY was recently elected to the CQ DX Hall of Fame. Congratulations, San!

The rest of the group ducked down the hatchway to escape the gunfire, with the FT7 still on the air. "Fire on board, Fire on board!" was the last radio communication heard from the now burning vessel. The group, now certain they would have to abandon their craft, escaped the cabin through the skylight. They grabbed a 70-liter fresh water tank and lashed empty fuel barrels to it to keep it afloat, but their dinghy was hanging from the stern of their yacht, which was engulfed in flames.

When the propane bottles for cooking exploded, the group abandoned the *Sidharta*. Jenny swam around the burning yacht to rescue their dinghy, which fortunately had been freed from the yacht as its lines burned through. The shelling continued as the group piled into the tiny 14-foot boat, and one round opened a hole in the dinghy. They used what little clothing they had brought with them to block the inflow of water, but they had to bail continuously thereafter.

Meanwhile, they continued to call for DJ4EI, but they saw no trace of Mueller after the third shell. Their careful salvage of the fresh water tank was for naught; it drifted out of reach. Water in the other tank was contaminated with seawater and undrinkable. The gunfire continued as the dinghy drifted slowly away from Amboyna under the pressure of southwest winds. Fortunately, the high seas screened them from most of the gunfire, but the group huddled in the bottom of the little boat as shells rained down around them.

At first, the spirits of the five remaining members of the DXpedition were good, despite the ordeal of losing their good friend Mueller, the yacht, and radio gear, not to mention the end of their DXpedition plans. They knew they had been in radio contact up to the minute they abandoned ship, with their location well known. It wouldn't be long, they reasoned, before a plane would drop a well-equipped life raft and supplies, followed by eventual rescue.

But days began to pass without a plane in sight. Baldur inventoried their supplies in the dinghy: their bathing suits, a couple of T-shirts, Baldur's parka, a woven basket, a glass jar, a screwdriver, and a couple of empty fuel cans. They rigged the empty cans as sea anchors to help stabilize the tiny craft, and used the screwdriver to remove a stainless-steel plate at the stern of the boat, where the outboard motor would be attached. They intended to use the shiny plate as a mirror to attract the attention of rescue craft.

Peter Marx, an able seaman with a German license, provided invaluable advice on survival in the open boat. Without food or fresh water, they could not exert themselves in any way, so they dismissed the idea of rowing. As the sun beat down and there still were no rescue planes, the survivors fashioned a rough tent-like cover from Baldur's parka and Jenny's sarong, but it provided little shelter. Baldur tried to catch fish with the woven basket, but his only luck was with tiny, finger-sized minnows. The still-living fish were difficult to swallow without water, and most of the survivors gave them up even before the basket drifted away.

Baldur, now deeply concerned that they would not be rescued, scratched an account of what had happened on the back of the steel plate, using the screwdriver. Even if they all perished, the world would know what had taken place. Days continued to pass, with a NNE wind blowing them slowly toward shipping lanes to the south of the Spratly group. On the sixth or seventh night, a brightly-lit ship passed a short distance away, but they had no way to attract attention. The shiny metal plate was useless at night. As they drifted through the more heavily travelled shipping lanes, they saw more ships, but only at night.

Meanwhile, Gero Band DJ3NG grew steadily weaker and began to hallucinate that they had been rescued. He drank some seawater under the delusion that it was fresh, and this may have led to his death a short time later. At about 1:00 pm on April 18, Gero died, and was buried at sea, just 30 hours before the survivors were finally pulled from the sea.

Baldur, too, began to hallucinate, dreaming that a voice told him he would be rescued on the tenth day. As that tenth day in the dinghy without food or water ebbed into sunset, a large Japanese ship, the *Linden*, passed close by. The survivors couldn't yell with their dry throats, and the *Linden* sailed on by. But then Jenny noticed the ship had changed course, steaming around in a circle, back toward their dinghy! Rescue was finally at hand, after 243 hours!

The *Linden* pulled alongside, and Baldur scrambled aboard, the only survivor with the strength to do so unassisted. The Japanese crew of the Panama-registered *Linden* then took careful care of the weakened DXpeditioners. Small amounts of warm fresh water first, and then long-awaited showers began to restore their strength. Their medical problems were mainly sunburn, especially severe in Willand's case. The Japanese treated burn blisters on their hands, feet, and faces, and soothed the sores caused by sitting in wet bathing suits on rough wood for ten days. Strained rice soup and clean sheets completed their first evening after rescue; Baldur thought they were in heaven as he slipped into bed!

End of Part 1. Coming next month: The aftermath. Unanswered questions abound, and the last chapter of the Spratly saga has not been written. ***Copyright 1983, by Baldur Drobnica DJ6SI.***

DR. DIGITAL

Robert Swirsky AF2M
412 Arbuckle Avenue
Cedarhurst NY 11516

The most important development in the history of amateur radio came on October 28, 1982, and, unfortunately, it went by unnoticed. What was this event? The legalization of *any* digital (i.e., computer) code on the amateur frequencies above 50 MHz (except for the CW-only portions of 6 and 2). As long as the codes are not intended to make one's communications secret and a detailed record of the format of the digital codes is maintained, it is legal. For the complete rules, see part 97.7.

Why is this so important? Well, for one thing, hams are now free to *experiment*, something that was severely restricted under the old rules. In the past, it has been amateurs who pioneered various methods of communication; now hams can continue being pioneers.

It is impossible to go very far these days without encountering a microprocessor. These devices, in some form, can be found in everything from automobiles to watches. Amateur radio, being no different from anything else, also has been computerized. Practically all the new transceivers are microprocessor-controlled. Many hams have taken up the study and use of computers as a hobby. It is only natural that a person interested in electronics would want to learn about computers.

The typical ham's use of a computer, however, has been far from revolutionary. Sure, many hams have replaced their noisy Model 19 Teletype® machines with the silent CRT, but that really isn't enough. Computers can do so much more than simply send RTTY or CW, and one needn't spend a fortune to use a computer in other applications.

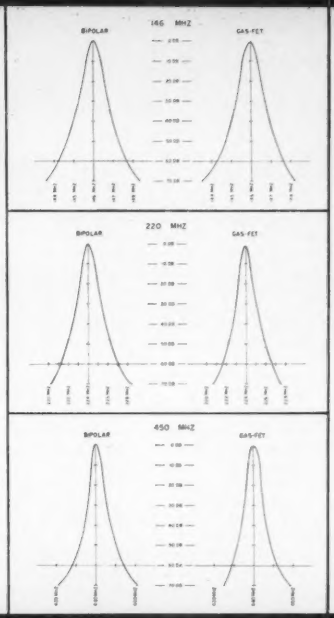
Computers can be used to assist with practically every mode of communication. Slow-scan television and facsimile can easily be enhanced using digital (computerized) techniques. Even voice communications can be digitized. Using a technique called pulse-width modulation, sound input can be digitized (converted from analog to a digital representation) and sent as digital data. Various techniques for compressing the data exist, and on the receiving end, the voice can be recreated using a digital-to-analog converter. Recent advances in integrated-circuit technology make experimenting along these lines well within the reach of any dedicated amateur.

The purpose of this column is to show other uses for a computer besides RTTY. Sure, RTTY is wonderful with a computer, but computers can do so much more. I will try to provide examples for all the popular microcomputers so that no one will feel left out. Particular emphasis will be on the lower-cost microcomputers. Where possible, I will show how some fancy software can take the place of elaborate hardware. By doing this, I hope to provide something

GLB HIGH PERFORMANCE PRESELECTOR-PREAMP

The solution to most interference, intermod, and desense problems in **AMATEUR** and **COMMERCIAL** systems.

COMPARE OUR CURVES!



Typical rejection:
± 600 Khz@ 144 Mhz: - 28dB
± 1.6 Mhz@ 220 Mhz: - 40dB
± 5 Mhz@ 450 Mhz: - 50dB

- 40 to 1000 Mhz - tuned to your frequency
- 5 large helical resonators
- Low noise - High overload resistance
- 8 dB gain - ultimate rejection > 80 dB
- 10 to 15 volts DC operation
- Size - 1.6 x 2.6 x 4.75" exc. connectors
- **FANTASTIC REJECTION!**

Price - $79.95 bipolar w/RCA jacks
Connector options: BNC $5, UHF $6, N $10

SUPER HOT! GaAs Fet option $20

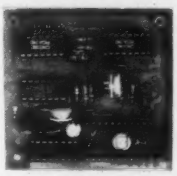
We offer a complete line of transmitter and receiver strips and synthesizers for amateur and commercial use.

CUSTOM DESIGN & ENGINEERING

Allow $2 for UPS shipping - MasterCard and VISA welcome

AUTOMATIC IDENTIFIERS

ID-1



ID-2

- For transceivers & repeaters
- Automatic operation
- Adjustable speed & amplitude
- Small size - 7 to 15 volts DC
- 8 selectable, reprogrammable messages - each up to 2 minutes long
- Wired & tested
- Programmed with your message(s)
- LOW COST

Model ID-1 - $39.95 Model ID-2 w/2 to 10 min. timer $59.95

GLB ELECTRONICS

1952 Clinton St., Buffalo, NY 14206
716-824-7936, 9 to 4

Call or Write for Free 1983 Catalog

143

TERMINALL

RADIO MODEM

apple · TRS-80 · ATARI

SEND & RECEIVE CW & RTTY

TERMINALL is a hardware and software system which converts your Personal Computer into a state of the art communications terminal.

- TERMINALL is easy to use. Plug into your receiver headphone jack and copy Morse code or radioteletype. Plug into your CW key jack and send Morse code. Attach a Microphone connector and send Baudot or ASCII RTTY using audio tones (AFSK). That's all there is to hooking it up.
- Fantastic Morse reception. No adjustments are necessary to receive Morse code. It's fully automatic! Six stage active filter demodulator and auto adaptive Morse algorithm copies the weak and sloppy ones.
- Separate RTTY and CW demodulators. Built in crystal controlled AFSK. CW and PTT keying. 60 mil loop interconnect. RS 232 IN and OUT, hand key input and side tone output.
- Built in parallel printer driver software allows hardcopy in all modes.
- Hardware clock maintains accurate time.
- Multiple user defined WRU functions. You select initiate sequence, terminate sequence, what to transmit back and whether to save on tape or disk.
- Word wrapping, word mode editing, diddle, ignore carriage returns, user programmable end of line sequence, adjustable carriage width, transmit delay (fixed, none or auto adaptive), excellent documentation, break mode and much more.
- TERMINALL has capabilities far surpassing dedicated terminal systems. And since it works on a general purpose computer, the majority of your investment (your computer) is spread out over many different applications. **You get more for your money.**
- Complete with software on cassette and diskette, assembled and tested hardware, and extensive instruction manual. Call or write for specifications on TERMINALL for TRS-80 Model I or Model III, Apple or ATARI 400/800 COMPUTERS. **$499.**
- 15 day money back trial period. One year parts and labor limited warranty on factory direct orders.

To Order
(209) 667-2888

MACROTRONICS, inc.
1125 N. Golden State Blvd.
Turlock, CA 95380

C.O.D.

Apple is a Registered Trademark of Apple Inc.
TRS-80 is a Registered Trademark of Tandy Corp.
Atari is a Registered Trademark of Atari Inc.
Shipping U.P.S. Reg. Del. $4.00 CA residents add 6% sales tax

NEW
FOR THE TRS-80* COLOR COMPUTER
MORSE CODE

Here's a way to turn your Color Computer into a complete CW Morse Code terminal.

—**KA9FSQ CW MODEM** Interfaces the computer to your transceiver via the **ROM-PAC** slot.
Cartridge: $50.00

—Three CW programs to choose from.

—**KA9FSQ TRANSLATOR** (Machine language)
TX programmable from 5-60 WPM, RX to 60 WPM. Features split screen operation, a 255 character keyboard buffer, and automatic CQ using your own call letters.
Cassette: $24.95

—**W9AV TRANSLATOR** (Extended Color Basic)
TX programmable 5-50 WPM, RX to 30 WPM. Includes 9 message memories, and a CW practice mode which sounds over your TV. Cassette: $14.95

—**W9AV QSO ROBOT** (Extended Color Basic)
TX programmable 5-50 WPM, RX to 30 WPM. Use the keyboard or Auto Mode. Makes complete CW QSO's without human intervention including exchange of calls, RST, QTH, and names. Also keeps a log. Cassette: $19.95

For additional information & programming, write to:

Mike Rice KA9FSQ
5953 N. Teutonia Ave.
Milwaukee WI 53209

MITRONIX

*Trademark Tandy Corp.

please include 5% postage

240

See List of Advertisers on page 114

for everyone, including those hams who don't have the kilobucks to spend!

Hams must get their computers talking to each other. Murray (Baudot) code at 60 wpm simply is not the most efficient way for two computers to communicate. What is needed is a faster, more reliable method with error-correction and error-detection. Not only text can be sent, but programs, graphics, and even data representing music and sound!

Before hams can start getting their computers on the air, some standards must be established. In the coming months, I will set forth my own ideas regarding such standards. Now you may be saying to yourself, "Who is this AF2M to go around setting standards?" Well, why not? I am not affiliated with any ham radio or computer manufacturing company, so I will be completely objective. My suggestions for a digital communications standard are:

1) Low cost. No expensive or unusual hardware should be required.

2) Easy implementation on any computer. Individuals with a Timex 1000 and an IBM PC should be able to communicate.

3) Software over hardware. I favor the software solution to an interfacing problem. In my opinion, it is much easier to tinker with op codes than with chips.

4) Reliability. There should be error detection and correction.

I would like to see computer graphics exchanged over the air, even between different computer systems. There are some graphics standards around now; it is time to start implementing them!

I think I'll get off the soapbox now and start in with the fun stuff.

CASSETTE-PORT QSO

The new FCC rules now allow for cassette-port QSOs. If you are on VHF, you can exchange programs or data over the air with the cassette I/O. Of course, it is only possible to exchange data with someone who has the same type of computer (or an emulator). It takes a little fiddling with the volume levels, but it is possible. Better results can be obtained if the audio is regenerated before it is sent to the computer. Regeneration is almost always necessary with the VIC-20 and VIC-64 computers. However, fairly good results can be obtained with the Apple, TRS-80 I or III, and the Timex/Sinclair computer with no additional circuitry. Once the proper volume levels are established, the data transfers can be just as reliable as cassette tapes are.

If you have an Apple, TRS-80, or Timex/Sinclair, simply connect the cassette output to the microphone input of the rig and the audio output of the rig into the computer. Make sure to use shielded cable to prevent the rf from the computer from interfering with the radio. Fortunately, on the VHF and UHF frequencies where this type of operation is legal, computer RFI becomes less of a problem. Carefully monitor your transmitter output and adjust the microphone gain for a normal amount of deviation—about the same as you would expect from a voice signal. To set the proper receive level, use the same procedure as you would to set the level of the cassette recorder. It might take a little experimentation, but once the proper settings are found, you won't have to worry about them again.

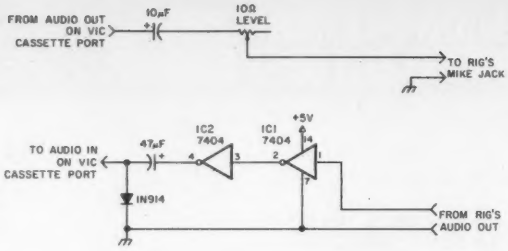


Fig. 1. VIC-20 cassette-port-to-ham-rig interface.

With a Commodore VIC computer, try the circuit shown in Fig. 1. The integrated circuit is just a 7404 hex inverter to ensure that a perfect square wave goes into the computer. To feed audio into the rig, the 10-μF capacitor improves the audio quality. Fig. 2 shows the pinout of the VIC-20 cassette port. Note that you can power the interface circuit from pin B-2. It is important that you ground pin F-6; this makes the computer think that the cassette recorder is connected and the Play switch has been depressed.

Cassette-port I/O isn't the best way, but it sure is cheap. With just a minimal amount of experimentation, you can have your computer on the air and start exchanging programs!

ERROR-CORRECTING CODES

When transmitting data, it is useful to have some way of detecting errors and correcting them. There are many methods of accomplishing this. Let's begin with a discussion about parity.

When data are sent over a computer, they are usually encoded in any one of several standard computer "alphabets." The one used by most of the computer industry is called ASCII (pronounced askey). In the standard ASCII code (there are several variations of it), each character takes up seven elements called *bits*. When transmitted serially, the least-significant bit is transmitted first and the most-significant bit is transmitted last. In order to ensure that no bits were lost during transmission, a parity bit can be generated and sent as an eighth bit.

There are two types of parity: even and odd. In even parity, the parity bit is sent so as to make the *total* number of "1" or "ON" bits (including the parity bit) even. In odd parity, the total number of "1" bits is made odd. For example, if the ASCII code 1011001 was to be sent, the parity bit would be a zero if you were using even parity, and it would be a one if you were using odd. At the receiving end, if odd parity was being used, any byte with an even number of "1" bits indicates an error. For even parity, an odd number of "1" bits received means an error. There is no advantage to using even parity over odd parity; it would be nice if everyone used the same.

The software for generating or checking parity is very simple. They both involve the use of a logical exclusive OR (XOR). In case you are not familiar with the various logic functions, study the truth tables in Fig. 3. Note that the exclusive OR is similar to addition except that the carry bit is ignored. To generate the parity bit, perform the following algorithm:

1. Initialize a temporary data bit (0 for even parity, 1 for odd).
2. Take the first data bit and exclusive OR it with the temporary bit.
3. Repeat step 2 for the next six bits.
4. The temporary bit is now equal to the parity.

If you are receiving ASCII data, *compare* the generated bit with the received bit. If you are sending ASCII, *transmit* the parity bit as your eighth bit.

Now that you can detect errors, it would be nice if you can correct them as well. In order to do this, some redundancy must be introduced. The greater the redundancy, the more errors can be corrected, but efficiency will be sacrificed. The simplest method of error-correction is called the longitudinal-redundancy check (LRC). This is simply having a "vertical" parity across several bytes, in addition to the "horizontal" parity. For example, suppose the following bytes are to be transmitted (using odd parity):

00010000
10100001
00000001
11110001

The bit on the right is the parity bit. To use the LRC, a fifth byte is generated. (I simply chose to have the four-byte block; it can be any fixed length.) We'll use the odd system throughout. The sum of each column, except for the parity column, must be odd. That would make the LRC byte equal to:

10111110

The algorithm for generating the LRC is similar to generating parity:

1. Initialize a temporary byte (0 for odd, 1 for even).
2. Exclusive OR the first byte in the block with the temporary byte.
3. Repeat step 2 for the next three (or n-1) bytes in the block.
4. Generate a parity bit for the temporary byte, and put it in the MSB position.
5. The temporary byte now contains the proper LRC value.

Using the LRC to fix an error is simple. When data are being received, the computer is generating its own parity and LRC information. If what the computer generates doesn't match what was sent, an error has occurred. Suppose that the second byte in the example was received incorrectly as 10000001. The computer would know this was wrong because there is an even number of bits (2) and we are using odd parity. The LRC byte would also be wrong; 10011111 would be generated by the receiving computer while 10111110 would be transmitted to it. To correct the error:

1. Exclusive OR the generated LRC byte with the received LRC byte (ex. 10111110 XOR 10011111 gives 00100001).
2. AND the parity bit of this result with zero, thus setting it to zero.
3. Exclusive OR the resulting value with the byte that had the parity error.

That's all there is to it. The erroneous bit will be flipped back to the proper value!

The LRC certainly isn't the best method for error-correction, but it is the easiest to understand and implement. There are better methods, known as cyclic-redundancy checks (CRC), that can't be "fooled" as easily as the LRC. I will go into the CRC in a coming column.

Coming up also will be a detailed discussion of the various cassette-port standards and how to make them more reliable for over-the-air use. Also, we will be examining some inexpensive computerized methods of generating and decoding SSTV.

If you are doing anything with computers and ham radio, please drop me a line. I would also appreciate any comments regarding standards for computer-to-computer communication, expecially with regard to the encoding of computer graphics.

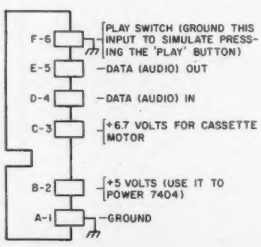


Fig. 2. VIC-20 cassette-port pinout.

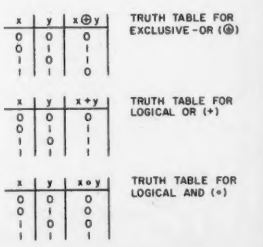


Fig. 3. Truth tables.

HAM HELP

I am looking for literature on Peltier electrodes. I am particularly interested in information on how to make them or use them to make a microsample osmometer.

Carlos P. da Costa MD, PhD
Rua dos Navegantes 541, Apt. 602
Boa Viagem, Recife
PE 50000 Brazil

I need a copy of the schematic and crystal information for an AN/PRT 4A transmitter.

Cletus G. Reinsel W3HWM
RD 1 Box 405A
Oil City PA 16301

I'm looking for schematics for the Wilson 1402-SM HT. I will pay for copying and mailing costs.

Robert Good KA8QBM
613 SE 89th St.
Berryton KS 66524

I would like to hear from anyone who has made receiver modifications to the Kenwood TS-700S or SP, and anyone who has constructed a 2-meter amplifier using the 4CX250 B-R or 8930.

Connie Mercer
HHB 32nd AADCOM
APO NY 09175

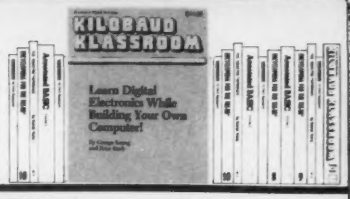
WAYNE GREEN BOOKS

KILOBAUD KLASSROOM

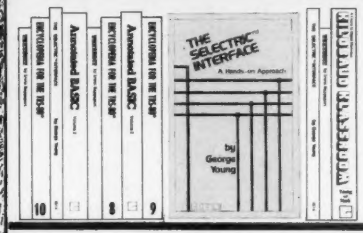
by George Young and Peter Stark

Makes learning electronics fun and easy. First published as a series in *Kilobaud Microcomputing*, the book combines the learning of essential theory with practical, hands-on experience. The course begins with basic electronic projects and culminates in the construction of your own programmable microcomputer. The direct instructional methods of authors Young & Stark make KILOBAUD KLASSROOM a simple way for you to acquire a solid background in digital electronics.

BK7386 (419 pages).....$14.95



THE SELECTRIC INTERFACE by George Young



You need the quality print that a daisy wheel printer provides but the thought of buying one makes your wallet wilt. The SELECTRIC™ INTERFACE, a step-by-step guide to interfacing an IBM Selectric I/O Writer to your microcomputer, will give you that quality at a fraction of the price. George Young, co-author of *Kilobaud Microcomputing* magazine's popular "Kilobaud Klassroom" series, offers a low-cost alternative to buying a daisy wheel printer. The SELECTRIC INTERFACE includes: step-by-step instructions, tips on purchasing a used Selectric, information on various Selectric models, including the 2740, 2980, and Dura 1041, driver software for Z80, 8080, and 6502 chips, tips on interfacing techniques. With The SELECTRIC INTERFACE and some background in electronics, you can have a high-quality, low-cost, letter-quality printer. Petals not included.

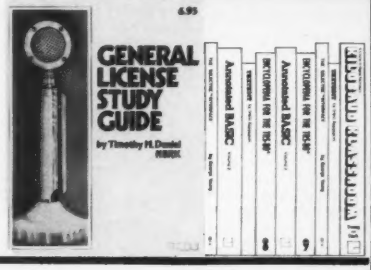
BK7388 (125 pages).....$12.97

GENERAL LICENSE STUDY GUIDE

By Timothy M. Daniel N8RK

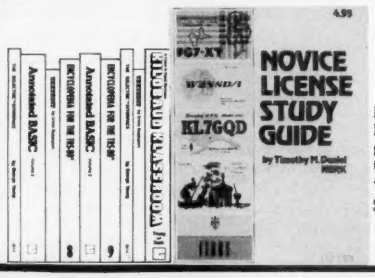
This is the complete guide to the General License. Learning rather than memorizing is the secret. This is not a question-and-answer guide that will gather dust when the FCC issues a new test. Instead, this book will be a helpful reference, useful long after a ham upgrades to General. Includes up-to-date FCC rules and an application form. Order yours today and talk to the world.

SG7358 (87 pages).....$6.95



NOVICE LICENSE STUDY GUIDE

By Timothy M. Daniel N8RK



Here is the most up-to-date novice guide available. It is complete with information about learning Morse code, has the latest FCC amateur regulations and the current FCC application forms. This guide is *not* a question/answer memorization course but rather it emphasizes the practical side of getting a ham license and putting a station on the air. It reflects what the FCC expects a Novice to know without page after page of dull theory. The most current information still available at last year's price.

SG7357 (98 pages).....$4.95

THE NEW WEATHER SATELLITE HANDBOOK by Dr. Ralph E. Taggart WB8DQT

Here is the completely updated and revised edition of the best-selling *Weather Satellite Handbook*—containing all the information on the most sophisticated and effective spacecraft now in orbit. Dr. Taggart has written this book to serve both the experienced amateur satellite enthusiast and the newcomer. The book is an introduction to satellite watching, providing all the information required to construct a complete and highly effective ground station. Not just ideas, but solid hardware designs and all the instruction necessary to operate the equipment are included. For the thousands of experimenters who are operating stations, the book details all procedures necessary to modify their equipment for the new series of spacecraft. Amateur weather satellite activity represents a unique blend of interests encompassing electronics, meteorology and astronautics. Join the privileged few in watching the spectacle of earth as seen from space on your own monitoring equipment.

BK7383 (132 pages).....$8.95

FOR TOLL-FREE ORDERING CALL 1-800-258-5473
WAYNE GREEN BOOKS•PETERBOROUGH NH 03458

Itemize your order on a separate piece of paper and mail to Wayne Green Books, Att: Sales, Peterborough, NH 03458. Be sure to include check or detailed credit card information. (Visa, MC or AMEX accepted.) No C.O.D. orders accepted. All orders add $1.50 for the first book, postage and handling; $1.00 each additional book; $10.00 per book foreign air mail. Please allow 4–6 weeks after publication for delivery. Questions regarding your order? Please write to Customer Service at the above address.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
c/o 73
Peterborough NH 03458

In the last published installment of this column (July), I was leading up to a byte-by-byte look at how to implement a RTTY terminal program on several popular computers. A look was planned at several popular microprocessors in the 6800/6502 families, with the programs to be designed around these chips. Unfortunately, the powers that be, read editors, feel that such a topic is too esoteric for this column. So I shall continue to develop this program over the next few months on the side, and then try to make it available for those interested. Watch this column for an announcement. It will be a bit, though, because as observant readers may note from the top of this column, I am still moving and things get a bit tight now and then. But bear with me, OK?

Let's see what some of you are involved in these days. I am in receipt of a card from Dieter Kaerger, from West Germany, who is interested in various forms of encoded RTTY. Well, in the planning stage is an in-depth look at some of the schemes now in use, including but not limited to AMTOR. I would be interested to hear what the readership has to say on these exciting new techniques which allow almost error-free RTTY under less than optimal conditions. What equipment are you all using? What's good and what's a lemon? Let me know what you have found out and I will see if I can put all this combined knowledge into a useful form for all to benefit from.

This brings up the subject of manufactured equipment mentioned in this column. With few exceptions, I try only to write about equipment I have seen or a close friend has seen. I have tried to avoid rewriting press releases or ads—you can read those as well as I. Normally, the "New Product" blurbs you read in magazines are prepared from such manufacturer-supplied information and are likely to provide all the good points and none of the bad. I have now been burned a few times and will attempt to screen out the truth from the puffery.

Henry Townsend AF2U, up in Cape May NJ, drops me a line. No Cape May diamonds in the letter, though. I remember looking for those beauties on the beach years ago. Henry is looking for a circuit to display RTTY on a converted television set. We have dealt with this many times and my advice still stands. If you can convert the five-level RTTY to ASCII (and the multitude of articles to help you do that have been listed here many times), any of the available terminal boards will do just fine. Scan the ads; there are video display boards capable of building a stand-alone "dumb" terminal available for a reasonable price, and kits for less. I am sending Henry a list of articles published here in the past; those of you who are still confused about this topic should check through previous editions of this column.

Are you at all interested in a compilation of old columns? Drop the editors at *73* and Wayne Green Books a note and send me a copy, too. I would be happy to work up a compilation of the first five years or so of "RTTY Loop" (we are in our seventh year now), but I need some feedback that there is a desire to have the book published. This information is here and ready to be assembled, but the folks in Peterborough want to be sure there is a market before starting the project. Let us know.

Barry Travis N4FNZ, in Arlington VA, sends along a letter of distress. Barry has a monitoring oscilloscope, model OSA, using a 913 cathode-ray tube. He has been unable to find a source for this tube in the ads. Anyone out there in RTTYland able to help Barry should write him at 605 N. Irving Street, Arlington VA 22201. Good luck, Barry.

Another ham in need is Lynn Finch W2MSJ, from Port Crane NY. Lynn is using a Commodore 64 on RTTY and has a monitor which he would like to convert to use with the C-64. This was part of an ITT computer, is labeled STANSASB E25240 0000, and was apparently made in Sweden. Lynn is anxiously awaiting any information at Route 369, RD 2, Box 789, Port Crane NY 13833. Don't let him down!

People do help others. In June, I mentioned that Charles Hoppesch was looking for a RTTY program for the TRS-80 Model III. I have a letter here from William Buckingham, in Osceola PA, who advises of *The Disassembled Handbook for TRS-80*, a five-volume set from Richcraft Engineering which apparently contains a RTTY program for the TRS-80. I have not seen the book or program, but Bill indicates that it is quite a program and that he has it up on his computer. You might keep an eye out for this book in your local computer/ham shop. If I get more information on this one, I shall pass it along forthwith.

I would like to point out, by the way, to folks like Ernest Nyberg K4GYI, in Lake Worth FL, that this program is also adaptable to the old TRS-80 Model I. Now, this rig had its share of problems with TVI and RFI and the like. But it is a good machine underneath it all, and if you can lick the interference problem, this book may be of some use to you as well. I would be interested to hear from you when you get the Model I on the air. That's not *if*, but *when*!

The VIC-20 has some new folks using it. One of them is SFC Lawrence (Skip) Barley, Jr., overseas with the US Army. Yes, Skip, you can use the VIC-20 on RTTY, but you will have to use a program designed for the VIC-20, as opposed to the TRS-80 program mentioned above or one for some other computer. We have touched on a few of these in the past and you mention in your letter that you will be looking at back editions of "RTTY Loop," so I hope you have seen some of the information we have printed. I have not had any feedback either way on the several hardware adapters on the market nor have I tried any of them. But watch this column for future information as it becomes available.

Regards to Dale Parfitt WA2YPY, a devoted 6800 user from West Palm Beach FL. Dale indicates that a score or more hams in his area are using 6800s and would like RTTY programming. Hang in there, folks, I hear you. I will have something for you in the not-too-distant future. And thanks for your support.

Hey, how many of you are using RTTY mailboxes of one sort of another? Why not drop me a short note, listing the boxes you are using, protocols, likes and dislikes, stuff like that. I will try to publish what I receive so that good ones get better and super ones rub off on the rest. Just drop a note to me in care of *73* for now, and be sure to enclose an SASE if you would like a personal reply. But be patient, OK?

AMTOR, remote mailboxes, ASCII—we have all come a long way from an old Model 15, haven't we? The range is huge, but every month I try to distill it down to potability here. Let's see what turns up next month in RTTY loop.

LETTERS

MAILBOX FULL

HELP! Because you were thoughtful enough to publish my letter (March) setting the record a little straighter about life and living in Latin America (particularly on the Emerald Coast of Colombia), I have been deluged with mail from your readers.

So, may I, through your "Letters" column, assure them I am most delighted with their responses and will eventually answer each and every letter? Muchas gracias!

Juanita Bird
Santa Marta, Colombia

DUSTY DESIRES

We would like to ask your assistance (and that of your readership) in a project that our museum is involved with. We have a need for our displays for World War Two US communications equipment. Specifically, we need both portable (manpack) and vehicular radio sets along with all related components including vehicle shock mounts. These will be incorporated into our displays to complete vehicles. Our needs do not include radios or components unique to fixed station, shelter-mounted, or aircraft application.

There can be no question that the quality and quantity of US communications equipment was a significant factor in the success met on the world's battlefields. We feel that it is very important that selected items of this material be preserved and displayed. We would very much like to hear from individuals who have such equipment, no matter how insignificant it may seem, and who would like to aid us in this project.

Terrill M. Aitken
Capt. SC ORARNG
Curator
Oregon National Guard
Military Museum and Resource Center
Camp Withycombe
Clackamas OR 97015

AMTOR WARNING

As you know, the latest form of RTTY communications to be of interest to hams is called AMTOR, which has been used by the maritime services. The AMTOR processor board converts the synchronous signals to standard Baudot 60- or 66-wpm signals for the terminal.

For a number of years there has been a video terminal advertised that has been quite popular in this area. It is a low-cost unit that operates in both the Baudot and ASCII modes at 45 to 300 baud. This is a high-quality unit that has been well worth the cost. I am referring to the Xitex SCT-100.

There are a few items in the SCT-100, however, that are problem areas. When the unit receives a quote character, it displays the numeral 5. When it receives an exclamation character, it displays a quote. Typing a quote character transmits an exclamation mark and, if you type an exclamation, nothing is transmitted.

The problem becomes major when using the SCT-100 with an AMTOR converter. The "over" signal used in TOR is quote/question mark. Since the SCT-100 will not transmit the quote, it cannot, therefore, be used with TOR. The "over" signal is not just an indicator for the other station to begin transmitting; it actually controls the TOR circuits and is necessary for mode A operation. I think that there are probably many SCT-100 users out there who will try to use their 100s and perhaps wonder why they will not function properly.

Bob Roehrig K9EUI
Batavia IL

Bob, stop griping about the problem and get me a modification of the SCT-100 so owners can cope with AMTOR—Wayne.

RYAN'S HOPE

Wayne, you're the "devil's advocate." I call you that because I'm sure that, had you chosen a career in the clergy of the Roman Catholic Church, you would have early on filled that post in Rome.

I feel that you are, unfortunately, at least fighting a losing battle in trying to reform the members of our mutual hobby with respect to their manners (I refer to the letter from Bill Skipper KØARG in the May '83 "Letters" column). It's impossible! You're attempting that which all the priests, rabbis, and other assorted clergymen over the past 10,000 years of human history have not been able to accomplish. After all, all hams (at least most of them, anyway), are members of the human race.

One need only listen in on 14.230 MHz sometime (that's where the SSTV folks hang out on 20 meters) for a while. Not only is there squabbling between those running SSTV and those who suddenly appear on frequency for other purposes (we won't even mention the habits of the DX and contest workers), but there's also even squabbling among the SSTVers themselves as to whether the frequency is for SSTV QSOs or SSTV "technical discussion" nets, etc. I've gone no further into this mode of our hobby than buying K6AEP's 7.4 SSTV program and probably won't, with all the squabbling. I can safely think of other modes to invest my dollars in (such as RTTY). No one can stop the squabbling—not even, should they try, the FCC. My, they even squabble over

which SSTV system is the best and knock, badly, what each doesn't have (or support). Now that's squabbling for you! In 29 years, in this hobby, I've never heard folks knocking other folks' equipment. It's an education in itself.

I can't agree with everything you apparently advocate, as I smoke cigars (no smoking) and am a retired police chief (some of your arguments against radar). However, I defend your right to speak out. Furthermore, I agree with your attempts to advance the hobby into the twentieth century (never mind the twenty-first) by pushing the various newer modes of transmission. Unfortunately, as John Edwards' "Fun!" column's annual poll results indicate, apparently the interest in any newer mode of operation (i.e., RTTY, SSTV, OSCAR, etc.) doesn't exceed 30%, and that only for the potential use of the OSCAR satellites. One gets the impression that, in reality, approximately 6-10% of hams are interested in advanced (post-1963) modes of operation. It's a pity, but considering the fact that it's a hobby and hobbies reflect the social habits of the predominant generation at the time, perhaps it's understandable. (I'm not knocking the younger generation, but simply making a statement of apparent fact. The next one, being brought up on home/school microcomputers, will be different.) (I wonder if all the CW enthusiasts have considered the fact that, as a mode, it's really digital!)

To reiterate, this is, after all, a hobby, and most hams drift in and out of activity, from mode (or interest) to mode throughout their hobby career, in varying cycles (almost like one's biorhythms). We are living in a world of increased specialization (look at the programming field, for example) and our hobby is becoming more varied daily. There will be more of this, as time goes on (your *73* for example, will probably become as specialized as *80 Micro* or *Hot Coco*). Don't fight it. Even *QST* and the league can't be all things to all people.

Enough of this. You and your publications serve a good purpose in the hobby, so whatever you do, don't get discouraged.

Joe Ryan WB5LLM
Florence MS

I dunno, Joe—once I saw everyone's slow-scan pictures I stopped tuning around 14,230, so I've missed the beefing. Me discouraged? Ha!—Wayne.

MINI-DOOMSDAYS

I appreciate your many editorials attempting to increase the size of amateur radio. You have suggested more interest in the clubs on a local level, more reading of ham magazines, and more encouraging of computer hobbyists to join the ham fraternity. I have read every editorial in *73* for the last year and you have overlooked one very important recruitment tool: emergency communications.

You did mention ham involvement in doomsday communication in the event of a nuclear war, but I am referring to floods, tornados, hurricanes, etc. This is when the spotlight falls on radio amateurs and our ability to communicate during emergency conditions for the public welfare.

All amateurs should remember that assisting official agencies with emergency communications is part of our charter. As we begin to interface our computers with our rigs, let us not forget the valuable role this equipment potentially has in an emergency.

Wayne, I believe your editorials will show less frustration if you forget about the old cronies standing in the way of progress. I do not think it is wise to repeatedly exhort this older group to "get with it." My experience has shown me that it is fruitless to attempt to budge this segment of amateurs.

I think it is more critical to prevent enthusiastic new hams from becoming lackluster, disinterested, out-of-date amateurs. I have seen emergency communications provide that stimulus to many hams. Whether it is a training drill on a weekend or providing communications for a walk-a-thon or air show, these activities really encourage direct ham involvement in which the amateur can really see his or her contribution to the community. At the same time, the ham receives the thanks of local residents.

I trust I have not overlooked any of your efforts in this area, Wayne; if I have, please forgive my oversight. I thank you for publishing a great amateur magazine.

David Sweigert WB9VKO
Beeville TX

You're probably right about the old-timers. One of our advertisers called the other day to tell us that his ads in 73 outpull those in QST by a wide margin because, as he put it, "too many copies of QST end up in convalescent homes." It is fun gearing up to handle emergencies and we should get what few youngsters we have involved with it. If we plan our emergency communications systems so that they will be able to work even after doomsday, then they'll be duck soup for ordinary disasters such as earthquakes and floods—Wayne.

MARS POTENTIAL

Your publisher has waxed eloquent on several occasions on what is wrong with ham radio and on what should be done to correct it. At times his zeal may have drawn him into simplistic or impractical solutions (e. g., I suspect that getting kids into high-school radio clubs is not the complete answer to the Japanese ascendancy in electronics and autos; there may be some managerial and political ramifications, too). But he touches on something for which there may be a solution in place and ready for development when he deplores the lack of an effective emergency amateur radio system. I refer to MARS.

Before throwing more brickbats at the Military Affiliate Radio System, consider what it is and what it might become. I have been a member of MARS for nearly 30 years and have served as State Director of two states, so I know the good and the bad of it pretty intimately. And I have developed some thoughts about what it needs.

What it does not need is further ignoring by the ARRL and other sources of support and publicity. MARS is "of, by, and for amateur radio operators" and deserves much more recognition than it gets.

If it were better, maybe it would get some of that recognition (and maybe it would represent more of a threat to the TCPN than it does). Its function of operating phone patches for overseas servicemen is well known and respected. But little else about MARS is heard. And, in truth, there is much about it that rates criticism.

Nevertheless, it is a network of dedicated amateurs, nation- and worldwide, with the equipment and training to operate in emergency conditions. More important, it has the *potential* to build on the framework of the system-in-being to make a formidable answer to the need for emergency communications.

What it needs is money and support. When I first joined, there were six regional directors of the system; now there are only three. Where each office used to have at least adequate personnel to handle the vast paperwork and hardware requirements, now the eastern third of the US is administered by one sole individual. This is a result of government cutbacks in funding and it is hurting the system. What is the source of funding? Congress, of course. Letters to your congressmen are needed.

One glaring fault in MARS seems like it would be easily correctable: the fact that there are three separate MARSes. They should be integrated. Each state has an Army, a Navy, and an Air Force MARS, and they can't talk to each other! But nobody in authority has been willing to take this one step that would improve MARS about 500% in traffic handling and bring an enlarged system into much more contact with technically-skilled operators. They're out there but, splintered as MARS is, there isn't too much incentive to get things going.

Even with all the shortcomings inherent in association with the government and the military, government *with support* can get things done. MARS membership is an aging population, but more support and a revitalized system would reflect itself in more aggressive recruiting. Young people are welcome in MARS but they aren't showing up. MARS languishes, badly in need of just a few sparks to set it off.

73 would do inestimable good if it threw its formidable clout behind MARS. MARS is perfect for some boat-rocking, which *73* seems to enjoy. You are not bogged down with old fogies that hate change. And you have influence. How about it: Give us some help? Twist some arms; boost us some; encourage hams to look into MARS; hell, even bad-mouth us if you want to. At least that's better than being ignored!

John A. MacGahan W2DJM
Haines Falls NY

MARS could get a new lease on life if some of the members would take the interest to write about it explaining what, if any, the benefits are from joining. And while I don't think I've anywhere suggested that getting kids interested in amateur radio is the entire solution to the Japanese problem, I'm not sure how MARS fits in as a solution either. If there are more benefits to joining MARS than costs, get the word out and you'll get members—Wayne.

BILAL

Some of my customers have found that it is very difficult to find me. They must be using old journals and are assuming that I am out of business. I'm not. My correct address and phone number are:

Ralph Bilal
Bilal Company
S. R. 2
Eucha OK 74342
(918)-253-4094

MEXICAN NET NEWS

During the past few years and presently, the North West Radio Amateur Club of Obregon, Sonora, has been operating the Mexican Emergency Net on 7.090 MHz, LSB, from 0300-0400Z (the time may change by an hour seasonally to seek optimum propagation for the coverage of the entire Mexican Republic.)

Its purpose is to handle emergency traffic, contact air, maritime, and land-mobile stations, and receive check-ins from amateurs throughout Mexico. We believe this net will be of value to the amateurs in bordering regions in the event of any joint emergency.

Christopher Petroff XE2BSG
Chihuahua, Mexico

Take your favorite H.T. out for a drive tonight.

VISA or MASTERCARD for same day shipment.

For $69.95 you get the most efficient, dependable, fully guaranteed 35W 2 meter amp kit for your handy talkie money can buy.

Now you can save your batteries by operating your H.T. on low power and still get out like a mobile rig. The model 335A produces 35 watts out with an input of 3 watts, and 15 watts out with only 1 watt in. Compatible with IC-2AT, TR-2400, Yaesu, Wilson & Tempo! Other 2 meter models are available with outputs of 25W and 75W, in addition to a 100W amplifier kit for 430MHZ. ↙382

Communication Concepts Inc. 2648 N. Aragon Ave., Dayton, OH 45420 (513) 296-1411

↙See List of Advertisers on page 114

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

BRITISH COMMONWEALTH AWARDS

Through the cooperation of the Radio Society of Great Britain, I was able to obtain complete details of this great organization's awards program.

The following rules and conditions apply to all HF certifications and awards issued by the RSGB and should be read in conjunction with those governing awards and certificates individually.

All members of the RSGB will be afforded awards at no charge. Others must enclose at least 6 IRCs for each award. Applicants within the United Kingdom must submit QSL cards directly to the RSGB to justify their claim. All others may use the general certification rule with an affiliated society of a national organization.

Endorsements will be given for all-phone, all-CW, and/or single-band accomplishments.

Commonwealth DX Certificate (CDXC)

This certificate may be claimed by any licensed amateur who can produce evidence of having made two-way communication with stations located in at least 50 call areas listed on the Commonwealth call area chart. All contacts have to be made on 14 MHz, and an additional 50 contacts must be made in Commonwealth call areas on other bands. In the case of "other" bands, a particular call area may be claimed only once, irrespective of the band on which the call area was worked. The other call areas do not have to be the same as those worked on 14 MHz.

British Commonwealth Radio Transmission Award (BCRTA)

This award may be claimed by any licensed radio amateur who can produce evidence of having effected two-way communication with stations located in at least 50 of the call areas on any band or combination of bands. A five-band endorsement is available for 50 call areas on 5 bands.

Worked British Commonwealth Certificate (WBC)

This certificate requires the applicant to work at least one British Commonwealth station located in at least five of the recognized continental areas as defined by the ITU and noted in the List of British Commonwealth Call Areas. For the purpose of this award, North and South America count as one continental area.

IARU Region 1 Award

This award may be claimed by any licensed amateur who can produce evidence of having worked stations located in IARU Region 1. There are three levels of operating achievements: Class 1 requires contact with all countries in IARU Region 1. Class 2 requires contact with 35 countries within IARU Region 1. Class 3 requires contact with 20 IARU Region 1 countries.

To be eligible, all contacts must be made after January 1, 1979. Special endorsements are given for single-band or -mode achievements.

Members of IARU Region 1 are: Algeria, Austria, Bahrain, Belgium, Botswana, Bulgaria, Cyprus, Czechoslovakia, Denmark, Federal Republic of Germany, German Democratic Republic, Faeroes, Finland, France, Ghana, Gibraltar, Greece, Hungary, Iceland, Ireland, Israel, Italy, Ivory Coast, Jordan, Kenya, Lebanon, Liberia, Luxembourg, Malta, Mauritius, Monaco, Netherlands, Nigeria, Norway, Oman, Poland, Portugal, Rhodesia, Romania, South Africa, Sierra Leone, Spain, Sweden, Switzerland, United Kingdom, USSR, Yugoslavia, and Zambia.

To apply for any of the awards sponsored by the Radio Society of Great Britain, forward your application along with the award fee of 6 IRCs to: C. R. Emary G5GH, Westbury End, Finmere, Buckingham Bucks, England.

Cheshire Award

This award is issued in three categories: Applicants receive a gold award for accumulating 50 points, a silver award for accumulating 30 points, and a bronze award for accumulating 15 points.

Contacts must be made with only radio amateurs in the Cheshire County of England and there are no band or mode restrictions nor any date limitations.

Mode	UK Stations	European Stations	DX Stations
CW/SSB/AM	1	2	5
FM	1/2	5	10
SSTV/RTTY/OSCAR	5	10	15

Fig. 1.

Points can be claimed for all valid QSOs according to the example in Fig. 1.

Should you contact an amateur who resides in the County Town of Cheshire in Cheshire County, you may claim double point value.

The fee for this award is US $3.00 or 10 IRCs. This includes postage of the award which is attractively printed on parchment with an embossed seal signifying the category.

GCR apply; however, the Award Manager reserves the right to request QSLs prior to issuance of the award.

AFRICAN AWARDS

F. van Greunen ZS1IT wrote on behalf of the South African Radio League (SARL) and provided details for their very popular African awards program. A detailed description follows.

All Africa Award (AAA)

This award, sponsored by SARL, is made available to DXers throughout the world. Below is a list of areas in Africa from which QSL cards will qualify to obtain this award.

Confirmation must be submitted for one contact from each of the six ZS call areas as well as one contact from Botswana (A2), Lesotho (7P8), and Swaziland (3D6), plus one contact from 25 different areas of the remaining groups of country prefixes shown below.

A list indicating callsigns, mode, date, and time must accompany QSL cards submitted. Applicants who belong to IARU-affiliated clubs or societies may have

LIST OF BRITISH COMMONWEALTH CALL AREAS

EUROPE	
British Isles	
England (including Isle of Wight and Isle of Scilly)	G
Channel Isles: Jersey	GJ, GC
Guernsey, Alderney, and Sark	GU, GC
Isle of Man	GD
Northern Ireland	GI
Scotland (including Orkney, Shetland, and Western Isles)	GM
Wales	GW
Gibraltar	ZB2
Malta	(ZB1) 9H
Gozo and Comino	9H4
AMERICA	
Canada	
Maritime Provinces	VE1
Sable Isle	VE1
St. Paul Isle	VE1
Province of Quebec	VE2
Province of Ontario	VE3
Province of Manitoba	VE4
Province of Saskatchewan	VE5
Province of Alberta	VE6
Province of British Columbia	VE7
Yukon Territories	VE8
Northwest Territories	VE8
Province of Newfoundland (including Labrador)	VO
Bahama Islands	(VP7) C6
Barbados	(VP6) 8P6
Belize	VP1
Bermuda	VP9
Cayman Islands	(VP5) ZF1
Falkland Islands	VP8
Grahamland	VP8
Guyana	(VP3) 8R
Jamaica	6Y5
Leeward Islands	
Anguilla	VP2
Antigua and Barbuda	VP2
British Virgin Islands	VP2
Montserrat	VP2
St. Kitts - Nevis	VP2
Sandwich Group	VP8
South Georgia	VP8
South Orkney Islands	VP8
South Shetland Islands	VP8
Trinidad and Tobago Islands	(VP4) 9Y4
Turks and Caicos Islands	VP5
Windward Islands	
Dominica	VP2
Grenada and Deps	VP2
St. Lucia	VP2
St. Vincent	VP2
CALL AREAS WITH RESTRICTED DATE LIMITS	
Before June 1, 1961	
Union of South Africa:	
Cape District	ZS1
Cape Province (including ZS1)	ZS2
Marion and Prince Edward Island	ZS2
Southwest Africa	ZS3
Orange Free State	ZS4
Natal (including Zululand)	ZS5
Transvaal	ZS6
Before July 1, 1960	
British Somaliland	VQ6
Before April 25, 1964	
Zanzibar and Pemba	VQ1
Before December 1, 1967	
Aden	VS9
Kuria Muria	VS9
Kamaran	VS9
Before February 1, 1972	
Pakistan	AP
OCEANIA	
Australia	
Australian Capital Territory	VK1
New South Wales	VK2
Victoria	VK3

their QSLs verified through their affiliated organization.

All stations contacted must be fixed land stations. Islands around Africa or its coast do not count for this award. All contacts must be made after November, 1945, with a minimum CW report of 338 or phone report of 33. This award is issued free to SARL members; it is $.50 US or 10 IRCs for nonmembers.

Countries List: Algeria, Angola, Sudan, Congo Kinshasa, Burundi, Rwanda, Somali Republic, Cameroons, Egypt, Eritrea, Central Africa Republic, Republic of Congo Brazzaville, Gabon, Chad, French Morocco, French Somaliland, Ivory Coast, Dahomey Republic, Volta Republic, Mauritania, Senegal, Niger Republic, Republic of Guinea, Gambia, Ghana, Kenya, Liberia, Libya, Mozambique, Nigeria, Zambia, Malawi, Portuguese Guinea, Sierra Leone, Rhodesia, Spanish Morocco, or Ifni or Rio de Oro or Spanish Guinea, Tangier, Tanzania, Tunisia, Togoland, Uganda, Botswana, Lesotho, Swaziland, Southwest Africa, Republic of South Africa (ZS1-ZS6), Transkei, Bophuthatswana.

Applications and the appropriate award fee should be addressed to the attention of: F. van Greunen ZS1IT, Awards Manager, South African Radio League, PO Box 3911, Cape Town 8000, South Africa.

AWARDS FROM CERTIFICATE WORLD

I was very pleased to receive a letter from a new subscriber and to learn of his new adventure of collecting various amateur operating awards. Meet Stu Herring WB5ULD from Fulton, Mississippi. Stu features some very attractive awards for the parchment pursuer.

Representing Certificate World, we find his awards are made available to all US and foreign amateurs for two-way communication in the separate award areas. All modes of communications are accepted with the exception of those contacts via repeater.

All awards have a fee of $1.00 each or 6 IRCs. GCR apply. Apply by sending your list of contacts to: Certificate World, Rt. 2, Box 72, Fulton, Mississippi 38843.

The Old South Award

This certificate depicts a scroll listing the ten states of the Old South. It is awarded for contacts from each of the states of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

Old Man River Award

A certificate picturing the mighty Mississippi River and the ten states bordering the river can be yours for contacting the states of Arkansas, Illinois, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Tennessee, and Wisconsin.

Mississippi State Award

If you thought your first Mississippi QSO was hard to get, try making a total of ten to earn this award. A state outline and statistics add up to an interesting award for your hard work.

Capitals of the United States

This one will not come easy. You must have two-way communication with all 50 US state capitals, plus Washington DC. Fifty-one QSOs will earn you an award listing some facts about the US Capital and proof of a lot of hard work and fun.

There's a good chance you may have already qualified for some of these awards. If not, good luck on earning them. Let Certificate World hear from you and be sure to tell our friend Stu WB5ULD that you read about it in *73*'s Awards column.

SMIRK AWARDS

Ray Clark K5ZMS, representing the Six-Meter International Radio Klub (SMIRK), has forwarded some very impressive achievement awards for fellow six-meter enthusiasts to pursue.

To become a member of SMIRK, applicants must make 2-way contact by any normal emission with other members of SMIRK. US stations must log 6 contacts, while stations outside the US must log at least 3 member stations. All contacts must be made after October 14, 1973. Once this is accomplished, forward your claim along with $4.00 for a lifetime membership certificate.

Once a member, you then become eligible to apply for the other awards sponsored by this six-meter group. Separate awards are given for making contacts with 100, 250, 500, and 1000 SMIRK members, utilizing the same guidelines already mentioned. Cost is free to members of SMIRK.

And for those who want the ultimate challenge on 6 meters, SMIRK offers the DX Decade Award for having contacted ten DX countries on six meters. Endorsements are given for 15, 20, 25, etc., in increments of 5 DX country contacts.

To apply for the DX Decade Award, list all logbook information and enclose $3.00 for ten countries and $1.00 for each 5-country endorsement seal being applied for. For all correspondence with the SMIRK group, write: WA1KYH, SMIRK Award Manager, 18 Laurel Drive, Medfield MA 02052 USA.

ROCKWELL COLLINS

The amateurs at Rockwell-Collins will be manning AD0C within the Collins Telecommunications Products Division complex throughout the rest of the year (phone: 28600, 21300, 21355, 14280, 14210, 7275, 7190, 3950; CW: 30 kHz up). The station will commemorate the 50th anniversary since the incorporation of Collins Radio Company in 1933. A special QSL card will be available for amateurs contacting the station during 1983. QSL to Rockwell-Collins, Box 728, Cedar Rapids IA 52498.

CHELSEA FAIR CERTIFICATE

A special certificate will be presented to any ham radio operator making contact with the Chelsea Communications Club from August 30 through September 3. Contact can be made with WD8IEL on 40 and 80 meters from 2300Z to 0100Z. Send an SASE to 104 East Middle Street, Chelsea MI 48118.

OK CORRAL

On Labor Day weekend, September 3, 4, and 5, 1983, the famous OK Corral in Tombstone, Cochise County, Arizona, again will be the site of a special-event station. Operations will be carried on only a few feet from the actual site of the shoot-out between the Earp and Clanton factions. This station (KB7KZ) will operate in conjunction with the second annual Rendezvous of Gunfighters. Operations will begin at 1500 UTC, September 3, and continue through 2400 UTC, September 4, on CW and SSB. Frequencies as follows: SSB—28680, 21380, 14280, 7280; CW—21130, 7130. A certificate will be awarded to all who work us as well as SWLs. Please send a large 8½ x 11 SASE (40¢ postage) to KB7KZ, PO Box 36032, Tucson AZ 85740.

NORWALK OYSTER FESTIVAL

The Greater Norwalk ARC will operate a special-event station, WA1RXA, from the Norwalk, Connecticut, Oyster Festival on September 9, 10, and 11. Any ARS contacting WA1RXA will receive a special certifi-

Queensland	VK4
South Australia	VK5
Western Australia	VK6
Tasmania	VK7
Northern Territories	VK8
New Zealand	
Auckland District	ZL1
Wellington District	ZL2
Canterbury District	ZL3
Otago District	ZL4
Auckland and Campbell Islands	ZL
Australian Antarctic Territory	VK0
British Phoenix Islands	VR1
British Solomon Islands	VR4
Brunei	VS5
Chatham Island	ZL3
Christmas Island (Indian Ocean)	VK9
Cocos-Keeling Island	VK9
Cook Islands (including Rarotonga)	ZK1
Fanning Island (including Christmas & Washington Islands)	VR3
Fiji Islands	(VR2) 3D2
Gilbert and Ocean Islands	VR1
Heard Island	VK0
Kermadec Group (including Sunday Island)	ZL1
Lord Howe Island	VK2
Macquarie Island	VK0
Malaysia East	(VS4, ZC5) 9M6, 9M8
Manihiki Group	ZK1
Nauru Island	(VK9) C2I
New Guinea (including Bismarck and Admiralty Islands)	(VK9) P29
New Hebrides Condominium	YJ8
New Zealand Antarctic Territory	ZL5
Niue	ZK2
Norfolk Island	VK9
Papua	(VK9) P29
Pitcairn Island	VR6
Samoa	(ZM6) 5W1
Tonga or Friendly Islands	(VR5) A3
Tokelau or Union Islands	ZM7
Tuvalu	VR8
Willis Island	VK4
AFRICA	
Agalaga and St. Brandon	(VQ8) 3B6, 3B7
Aldabra Islands	VQ9
Ascension Island	ZD8
Lesotho	(ZS8) 7P
Botswana	(ZS9) A2
Chagos Archipelago	(VQ8) VQ9
Des Roches	VQ9/D
Farquhar	VQ9/F
Gambia	(ZD3) C5
Ghana	(ZD4) 9G1
Kenya	(VQ4) 5Z4
Malawi	(ZD6) 7Q7
Mauritius	(VQ8) 3B8
Nigeria	(ZD2) 5N2
Rhodesia	ZE
Rodriguez Island	(VQ8) 3B9
St. Helena	ZD7
Seychelles	(VQ9) S7
Sierra Leone	(ZD1) 9L1
Swaziland	(ZS7) ZD5
Tanzania	(VQ3) 5H3
Tristan da Cunha and Gough Island	ZD9
Uganda	(VQ5) 5X5
Zambia	(VQ2) 9J2
ASIA	
Andaman and Nicobar Islands	VU
Bangladesh	S2A
Cyprus	(ZC4) 5B4
Hong Kong	VS6
India	VU2
Laccadive Islands	VU4
Malaysia West	9M2, 9M4
Maldive Islands (Gan only)	VS9M
Sikkim	AC3
Singapore	9V1
Sri Lanka	(VS7) 4S7

cate upon sending an SASE to Joseph Beck, 26 Ambler Drive, Norwalk CT 06851.

Times: Sept. 9: 2200 to 0100 GMT, Sept. 10: 1500 to 0200 GMT, and Sept. 11: 1500 to 0000 GMT.

Frequencies: phone: 3890, 7240, 14305, 21385, 28600; CW: 3720, 7120, 14090, 21090, 28090.

BEAR BRYANT

The West Alabama Amateur Radio Society (WAARS) will operate a special-event station on Saturday, September 10, in commemoration of the birthdate of college football's winningest coach, Paul "Bear" Bryant.

WAARS will operate station W4WYP from 1300Z to 2400Z on that date. Frequencies will be the bottom 25 kHz on the General 40-15-meter phone band. The club will also work Novices on the bottom 25 kHz of the Novice band. The club will offer a handsome commemorative certificate of the event to any station worked by sending $1 and a large SASE to the West Alabama ARS, PO Box 1741, Tuscaloosa AL 35403.

STARVED ROCK RADIO CLUB

The Starved Rock Radio Club in Oglesby, La Salle County, Illinois, will operate their club station, W9MKS, on all amateur bands from their clubhouse on September 10 and 11. A suitable QSL is being designed for this period of operation, in celebration of 50 years of amateur radio in central Illinois.

JESSE JAMES DAYS

The St. Paul Radio Club (K0AGF) will operate a "railroad mobile" special-event station aboard a steam-powered train operating out of Northfield, Minnesota, during their Jesse James Days celebration. Operations will be from 1400 UTC until 2300 UTC each day, September 10 and 11. Frequencies: SSB—3.948, 7.267, 14.288, and 21.377. CW—3.552, 7.107, 14.057, and 21.057. A special certificate and QSL will be issued to those furnishing a 9 × 12 SASE (37¢ postage) and a QSL to those furnishing an SASE with 20¢ postage. QSL to St. Paul RC, PO Box 30313, St. Paul MN 55175-0313.

GEN. STERLING PRICE DAY

The Chariton Amateur Radio Society of Keytesville, Missouri, will operate KB0CC from 1400 to 2200 UTC on September 17, 1983, in celebration of the town's 150th anniversary and the annual General Sterling Price Day, honoring its favorite son of Civil War fame and governor of Missouri. Frequencies: phone—7.280 and 21.240.

LARGEST BLAST FURNACE

The Inland Steel Employees' Repeater Association is sponsoring special-event station KB9PQ, whose theme is "The Largest Blast Furnace in the Western Hemisphere, #7 At Inland Steel." The station will be set up in the Inland Steel parking lot and will be on the air from 1300Z Saturday, September 17, to 2400Z Sunday, September 18, operating all bands in the first 10-15 kHz of the General and the Novice portions of the band. The station will also be on 146.52/.52 FM. Certificates (a full-color picture of a blast furnace) will be available from ARS KB9PQ, 7605 Southeastern, Hammond IN 46324.

APPLE FESTIVAL

The Smithfield Apple Festival, held at Smithfield OH, is sponsoring a special-event station. Operation will be from 2300 UTC to 0400 UTC on September 23 and September 24, 1983. Operation frequencies will be: SSB—3.900 plus or minus 5 MHz; Novice—7.110 plus or minus 5 MHz. The station call will be N8CUX. Special certificates depicting the bed race will be sent to those who send a 4½" × 9½" SASE to Robert Carson N8CUX, 259 Hill St., Smithfield OH 43948.

NEW PRODUCTS

IC-751 HF TRANSCEIVER

Icom announces the IC-751 HF transceiver, featuring a new generation of technology and computer control. Icom's new CPU, with internal-battery memory backup, provides 32 memories with memory storage of mode and frequency, and the scanning capability to cover large segments of the spectrum very slowly, or to scan the memories by selected mode.

The IC-751 provides instantaneous band selection and has a 3-speed tuning system. Other features included are full break-in keying, passband tuning, notch filter, RIT and XIT with separate readout, FM built in as standard, a very steep-sided FL44 sideband filter, continuously adjustable noise-blanker levels, dual vfo operation, and all-mode squelch. A two-color fluorescent readout showing the frequency in white and the control functions in red, for visibility in all ambient light conditions, is standard. The IC-751 is equipped standard for operation from 12 volts dc, and there is an optional internal ac power supply.

For more information, contact *Icom America, Inc., 2112-116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

RTTY FOR THE VIC-20

Microfish Software Products has released two programs which use the Commodore VIC-20 as an inexpensive Baudot and ASCII RTTY terminal. These programs, RTTY3K and RTTY8K feature 60-, 66-, 75-, and 100-wpm Baudot, 110-, 300-, 600-, and 1200-baud ASCII, CW ID with the operator's callsign built-in, keyboard-operated transmit/receive control, and special-display-screen formatting for a more readable display.

These programs allow the VIC-20 to be connected to any terminal unit, commercial or home-brew, allowing flexibility in choice of RTTY equipment. Simple hookup instructions are given for connecting the VIC-20 to the TTL, RS-232, or current loop input/output of the selected terminal unit as well as the PTT connections to the transmitter or transceiver.

The RTTY8K version includes 10 large message buffers. These buffers are part of the program and do not have to be typed in or loaded from tape each time the RTTY program is loaded. All 10 buffers can be programmed and reprogrammed easily by following the instructions supplied. These buffers can also be changed easily while operating by using simple keyboard functions.

To eliminate repetitive typing, RTTY8K features three automatic messages. The automatic CQ message keys the transmitter, sends CQs followed by DE and the operator's callsign, sends the CW ID, and then unkeys the transmitter, all at the push of one key. Similarly, the automatic start-of-transmission message sends DE followed by the operator's callsign. The automatic end-of-transmission message sends the other station's callsign followed by DE and the operator's callsign, the CW ID, and then unkeys the transmitter.

On-screen status display is accomplished by an "intelligent cursor" that indicates whether Baudot or ASCII is in use, the speed, which message buffer is being sent, transmit or receive mode, and other special functions.

RTTY3K requires 3K of memory, while RTTY8K needs an 8K memory expansion. Both programs are available on cassette and include complete installation and operating instructions.

For more information, contact *Microfish Software Products, PO Box 920342, Norcross GA 30092.* Reader Service number 477.

THE TU-470 TERMINAL UNIT

The New Flesher Corp. TU-470 RTTY/CW terminal unit offers many standard high-performance features for your money. It receives up to 300 baud on all three shifts, provides TTL- and RS-232-compatible I/O including bipolar CW and PTT outputs for complete remote control and isolation of computer-level I/O keying.

Each TU-470 RTTY filter board is a high-sensitivity, high-Q, 3-stage, 6-pole active bandpass filter which provides excellent stability and sharpness. A signal-balance restorer circuit has been incorporated to allow reception of nonstandard RTTY shifts on mark only. The CW filter/demodulator has a 3-stage, 6-pole filter centered at 750 Hz for CW reception.

The TU-470 also provides crystal-controlled AFSK, FSK, a 170-Hz narrow preselector filter, built-in 20- or 60-mA loop supplies, autostart, threshold control, 5 LED indicators, bar-graph tuning, scope outputs, reverse receive, and reverse transmit.

For more information, contact *Flesher Corporation, PO Box 976, Topeka KS 66601; (800)-HAM-RTTY.* Reader Service number 479.

Icom's IC-751 HF transceiver.

The TU-470 RTTY/CW terminal unit from the Flesher Corporation.

The MAXCOM high-speed antenna matcher.

ANTENNA MATCHER

Magnum Distributing has introduced its MAXCOM automatic high-speed antenna matcher.

By using the latest in solid-state technology, MAXCOM will automatically tune one antenna from .3 MHz to 70 MHz with a vswr of less than 1.5, without external control leads, in either the dipole or long-wire configuration. MAXCOM matchers are available in three models covering 200, 1000, and 2000 Watts PEP. Their light weight and small physical size make them ideal for self-supporting dipole installations. (MAXCOM 200 and 1000: weight, 2 lbs.; size, 4.75" W, 3.75" H, 2.25" D. MAXCOM 2000: weight, 4 lbs.; size, 7.50" W, 4.75" H, 2.25" D.)

MAXCOM matchers are manufactured by Terramar Systems, Inc., of Fort Lauderdale FL and were initially developed for military and commercial applications that required extremely wide-spectrum, high-speed transmit and receive capabilities.

For more information, contact *Magnum Distributing, Inc., 1000 S. Dixie Hy. W #3, Pompano Beach FL 33060; (305)-785-2002.* Reader Service number 484.

FUNCTION BOARDS FOR S-100-BASED COMPUTERS

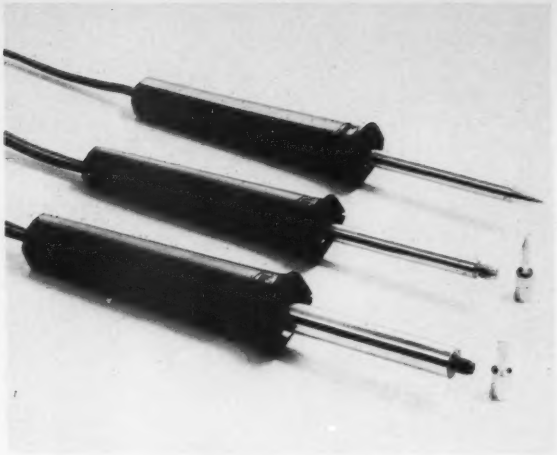
Industrial Computer Designs has announced four special function boards for S-100-based computers, together providing calendar, clock, alarm, timer, and 64-channel analog-digital-analog conversion capabilities.

The CCA-100 calendar/clock/alarm board can be used to display hours/minutes/seconds and day/month/year on a CRT, time events in second increments, and produce musical alarm tones over a four-octave range. Its brother CCT-100 calendar/clock/timer board can control events with 1/100th-second accuracy, keep track of computer time used, or calculate days elapsed between dates, all as hardware functions. Time/date information may be sent to a printer or stored as data, with all functions under software control. Both cards have long-term battery backup and utilize a minimal number of Z80/8080 ports for operation.

The D/A64-100 produces 64 analog outputs with 8-bit converter resolution, while the sister A/D64-100 board performs A/D conversion with similar accuracy. Voltages may be generated or read over a 0-to-5-V-dc range in 255 increments. The boards are port-selectable so that multiple cards may be used to create large systems as controllers for energy management, security, industrial control, or robotics.

ICD products are available through computer hardware distributors and dealers throughout the US and Canada, and will be supported by advertising in both trade and consumer publications. An owner's operation/service manual accompanies each card, which includes application and support software listings.

For more information, contact *Industrial Computer Designs, 31121 Via Colinas #1005, Westlake Village CA 91362; (213)-889-3179.* Reader Service number 482.



New soldering irons from Ungar.

UNGAR INTRODUCES NEW SOLDERING IRONS

Three new low-priced "consumer" soldering irons with Thermo-Duric heaters have been introduced by the Ungar Division of Eldon Industries, Inc.

Thermo-Duric heating elements reach soldering temperature faster, use less energy, last longer, and take less space than earlier wire-wound heating elements. Since the heaters were developed for industrial soldering systems, the new "consumer" line has soldering qualities and dependability appropriate for electronics technicians and prices to attract hobbyists and do-it-yourselfers.

The CM-25 has an integral nickel-plated cone tip suitable for small and large connections. The 25-Watt iron heats to 750 degrees F. The 45-Watt CM-45 and 80-Watt CM-80 can use any of 11 standard Ungar screw-on tips, and have three-wire cords to prevent leakage current damage. The CM-45 comes with an iron-plated pencil-tip point. Operating temperature is 700 degrees F. The large-capacity CM-80 comes with an iron-plated chisel tip and operates at 800 degrees F.

Slimmer, cooler handles were made possible by the efficiency of the "Thermo-Duric" heaters.

Further information is available from *Ungar, 100 W. Manville St., Compton CA 90220; in Canada: Eldon Industries of Canada, Inc., 500 Esna Park Dr., Markham Ontario L3R 1H5; (416)-495-9407.* Reader Service number 481.

PERSONAL HAM-TAGS

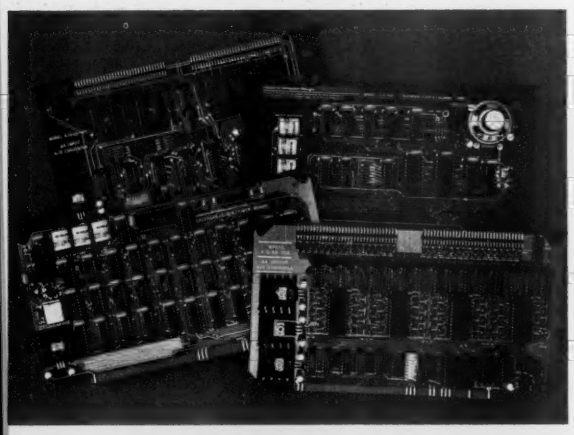
BHC, Inc., has announced its new "Ham-Tags." Ham-Tags are license plate frames personalized with ham radio call-signs. These frames are made from black molded ABS, the same material used for trim on most new cars.

A set of Ham-Tags consists of two black frames with white, permanent vinyl letters in the large imprint area. License plates differ from state to state, so you would have to check your plate to see if your call would go at the top or bottom of the frame. In states that have only one plate, BHC will furnish a frame for the rear and a plate for the front.

For more information, contact *BHC, Inc., 1716 Woodhead, Houston TX 77019; (713)-522-5755.* Reader Service number 483.

REMOTE-BASE CONTROL

A new intertie control has been introduced by Heil, Ltd., of Marissa IL. The RB-1 allows two-way control of two FM transceivers. A 2-meter transceiver can be connected to a UHF or 10-meter FM transceiver for remote-base operation. Sepa-



Function boards for S-100-based computers.

The Heil RB-1 remote intertie.

The Bird wattmeter field-strength plug-in element.

rate squelch and audio lines are fed from each rig, as is the PTT control line.

As the squelch of one rig is activated, the RB-1 will turn the transmitter of the second transceiver on. The reverse of this also happens, allowing complete remote-base control between the two transceivers.

The RB-1 can also be used as a complete repeater control for simple repeater systems or emergency operation.

For more information, contact *Bob Heil, PO Box 68, Marissa IL 62257; (618)-295-3000.* Reader Service number 476.

PROKEY SOFTWARE FOR THE VIC-20

The Prokey (and Prokey Deluxe) Software turns your VIC-20 into a full-featured CW keyboard. Of the two programs, one is designed to run on an unexpanded VIC-20. This program will provide normal CW keyboard sending with a ten-character buffer and a visual indication when the buffer is starting to get full. It also provides the capability of storing three user-programmable messages which can be changed while the program is running. You can also display the stored messages in order to check them. An abbreviated version of the serialized-contest-number generator is included, and an electronic notepad will let you keep track of the station you are talking to.

The second program requires a total of 7K of user memory and therefore expanded memory for the VIC-20. This program includes all of the features for the basic program and some special additions. A built-in clock will send the time in Morse code with just a single keystroke; a real-time clock will display the time on the corner of the screen; the beacon mode will allow a beacon message to be sent at any interval up to 23 hours 59 minutes; the logging mode will display log information automatically when you send $\overline{SK}$; and a screen-sized buffer allows editing capabilities.

For more information, contact *Jim Grubbs K9EI, PO Box 3042, Springfield IL 62708.* Reader Service number 478.

WATTMETER FIELD-STRENGTH PLUG-IN ELEMENT

The latest addition to the line of plug-in elements used with Bird directional wattmeters is an extremely sensitive relative field-strength element. Model 4030 expands the usefulness of Thruline™ wattmeters in the field by helping to optimize the radiated signal of any transmitter from 2 to 1000 MHz.

It is easy to increase the reach of business or personal transceivers, to extend the range of HTs by tuning, adjusting, and positioning antennas for maximum meter indication on the host wattmeter.

Model 4030 employs modern broadband circuitry instead of the highly reactive resonant networks of most field-strength meters. The element consists of a flexible receiving antenna, a single high-pass network, and a variable gain rf amplifier/detector. A battery-saving feature turns everything off when the element is removed from the wattmeter.

Typically full-scale deflection is obtained from a one-Watt CW source at 150 MHz through a quarter-wave antenna 8 feet distant. Dynamic range is at least 30 dB, and battery life is 100 hours or more.

For more information, contact *Bird Electronic Corporation, 30303 Aurora Road, Cleveland (Solon) OH 44139.* Reader Service number 480.

MOBILE PRODUCTS FROM BEALE ELECTRONICS

Beale Electronics has announced several new products for the mobile operator.

The CH-20 mobile antenna, designed by W0CZR and modified by KD0U, is compatible with Hustler and Hy-Gain masts. The antenna consists of a resonator and whip which, when added to your mast, has an overall height of 10 feet. This antenna has a broad bandwidth and is designed to handle full legal power.

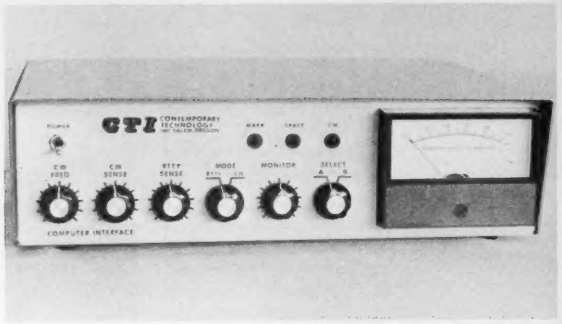
The DX-15 mobile antenna is also available. It is similar to the CH-20 antenna and also has an overall height of 10 feet.

A new mobile mast has also been introduced. It can be ordered in one 54-inch section, two 27-inch sections, or three 18-inch sections, or it can be custom cut.

The Power Cable Package includes all the connectors, wires, fuses, and plugs you need to connect a solid-state transceiver to your vehicle. The package also includes a cigarette-lighter plug for temporary installations.

Top it all off with the Beale magnetic mount. It has a 5-inch-diameter base and is compatible with standard HF mobile masts. The mount comes complete with coax, PL-259 connector, and cord for mast stabilization.

For more information, contact *Beale Electronics, PO Box 2641, Evergreen CO 80439.* Reader Service number 492.



Contemporary Technology's TMC-1B computer interface.

TMC-1B COMPUTER INTERFACE

Contemporary Technology has announced the TMC-1B computer interface for RTTY/CW. The TMC-1B will work with most home computers, including Commodore VIC-20, Commodore 64, Apple, Atari, and more. Software for the VIC-20 is included at no extra charge.

Some of the features of the TMC-1B include auto-start circuit on RTTY with a variable control on the front panel—you can adjust it to print only when you are on a solid RTTY signal; LC-tuned-circuit filter with a Q of 300 which offers greater sensitivity to weaker RTTY signals and also is more selective with crowded band conditions; and CW sense and CW frequency controls which give a threshold setting to copy a CW signal. With the CW frequency-adjust control you are able to adjust your rig farther from noise; it also will allow you to use most CW audio filters.

CTI has a built-in monitor speaker to allow you to hear the signal as it is sent in CW and RTTY mode. Also, an external speaker can plug into the TMC-1B for a loop through from your rig (or rigs) to a speaker.

The TMC-1B interface uses a CW LED to tune in CW. Mark and space LEDs indicate that you are on the RTTY signal, allowing you to see mark and space on an incoming RTTY signal.

With CTI, there is a single switch between two rigs (HF and VHF)—no plugs and cables to move. And no need to worry about + or − keying since CTI uses reed relays on the output for compatibility. There is high front-end gain (90 dB) for a wide-range in volume adjustment.

Other features included in the TMC-1B are: an RS-232 interface, a built-in printer loop supply (just add an optional transformer and power relay for printer motor), and an amateur 170-Hz shift as well as a 425-Hz shift for monitoring commercial signals.

The CTI TMC-1B is solidly housed in an 11"W × 3½"H × 10"D metal case for rf shielding. Simple hookup used RCA jacks for hookup to transceiver. Just run a line to MIC, to PTT, to speaker, and to CW key. Only one cable to the computer. All plugs for the computer are supplied as standard. The TMC-1B will work up to 300 baud ASCII.

The TMC-1B is fully guaranteed for one full year on all parts and labor.

For more information, contact *Contemporary Technology, Inc., PO Box 1083, Salem OR 97308; (503)-399-1370.* Reader Service number 491.

HUSTLER ANNOUNCES FIXED-STATION ANTENNA

The all-new Hustler 220-MHz vertical fixed-station amateur antenna, designated the Model G7-220, was recently introduced by Hustler, Inc. The G7-220 marks Hustler's entry into the now-popular 220-MHz band and complements their existing base and mobile amateur antenna line. The 7-dB gain of the antenna for both transmitting and receiving makes it the most powerful omnidirectional 1-1/4-meter antenna available. The all-new design keeps the signal radiation pattern at the lowest possible angle to the horizon for maximum efficiency and longest range.

The Model G7-220 has an swr of 1.5:1 across its entire 5-MHz bandwidth, with swr at resonance of 1.2:1 at the antenna. The radiating element is dc-grounded, and the antenna has a 50-Ohm base impedance.

This new Hustler 220 MHz vertical uses the best available corrosion-resistant materials for long life. Only Hustler uses all stainless steel hardware in amateur and professional products.

The 122" long vertical element and four 14-3/4" long radials of the G7-220 are made from high-strength, heat-treated aluminum. Each radial is 3/16" o.d. The N-type connector used on all new Hustler amateur verticals provides an all-weather seal and virtually perfect rf characteristics under all conditions.

The antenna weighs only 7 pounds and is easily mounted on any capable vertical support up to 1-3/4" o.d. Wind loading is only 26 pounds at 100-mph velocities.

For further information on this or other Hustler amateur products, write: *Sales Department, Hustler, Inc., 3275 North B Avenue, Kissimmee FL 32741.*

ALL HF BANDS !

The SLINKY DIPOLE® Antenna

A broadband, low SWR dipole that really works in apartments, small yards, attics, anywhere a small antenna is a must. Indoors or out, you can work ANY HF BAND, including 10 MHz. No gimmicks or add-ons. Imagine 80M in as little as 24 ft.! Complete kit and instructions, plus 50 ft. of coax. Easy to set up and adjust. More information available - just call or write.

Blacksburg Group
Box 242 Suite 500
Blacksburg, Virginia 24060
703/951-9030

$67.95 postpaid (in U.S.A.)
Money Back Guarantee
Virginia residents
add 4% sales tax

Orbit

ORBIT is the Official Journal for the Radio Amateur Satellite Corporation.

For a **SAMPLE COPY** please send $2 to:

(AMSAT), P.O. Box 27, Washington, DC 20047.

THE SELECTRIC™ INTERFACE

Daisy wheel quality without daisy wheel expense.

You need the quality print that a daisy wheel printer provides but the thought of buying one makes your wallet wilt. *The Selectric™ Interface*, a step-by-step guide to interfacing an IBM Selectric I/O Writer to your microcomputer, will give you that quality at a fraction of the price. George Young, co-author of *Microcomputing* magazine's popular "Kilobaud Klassroom" series, offers a low-cost alternative to buying a daisy wheel printer.

The Selectric™ Interface includes:

- step-by-step instructions
- tips on purchasing a used Selectric™
- information on various Selectric™ models, including the 2740, 2980, and Dura 1041
- driver software for Z80, 8080, and 6502 chips
- tips on interfacing techniques

With *The Selectric Interface* and some background in electronics, you can have a high-quality, low-cost, letter-quality printer. Petals not included.

Credit card orders call TOLL-FREE 1-800-258-5473. Or mail your order with payment plus $1.50 shipping and handling to: Wayne Green Inc. Attn: Retail Book Sales, Peterborough, NH 03458.
Dealer inquiries invited.

ISBN 0-88006-051-4 128 pages **$12.97**

☐ Yes, I want **Selectric Interface** (BK7388). Enclosed is $12.97 per copy plus $1.50 for shipping and handling.

☐ MASTER ☐ VISA ☐ AMEX

Card # _____ Expires _____

Signature _____

Name _____

Address _____

City _____

State and Zip _____ 339B6S

All orders shipped UPS if complete street address is given.

See List of Advertisers on page 114

MOVING?

Let us know 8 weeks in advance so that you won't miss a single issue of 73.
Attach old label where indicated and print new address in space provided. Also include your mailing label whenever you write concerning your subscription. It helps us serve you promptly. Write to:

73 Amateur Radio's Technical Journal
Subscription Department
P.O. Box 931
Farmingdale NY 11737

☐ Extend my subscription one additional year for only $19.97
☐ Payment enclosed ☐ Bill me

Canada and Mexico $22.97/1 yr. only US funds drawn on US bank. Foreign Surface $39.97/1 yr. only US funds drawn on US bank. Foreign Airmail, please inquire.

If you have no label handy, print OLD address here.

AFFIX LABEL

Name _____
Address _____
City _____ State _____ Zip _____

print NEW address here:

Name _____
Address _____
City _____ State _____ Zip _____

Dealers . . . SELL

Selling *73* will make money for you. Consider the facts:

Fact #1: Selling *73* increases store traffic—our dealers tell us that *73* is the hottest-selling amateur radio magazine on the newsstands.

Fact #2: There is a direct correlation between store traffic and sales—increase the number of people coming through your door and you'll increase sales.

Fact #3: Fact #1 + Fact #2 = INCREASED ALE, which means more money for you. And that's a fact.

For information on selling *73*, call 800-343-0728 and speak with Ginnie Boudrieau, our bulk sales manager. Or write to her at *73*, Route 101 & Elm St., Peterborough, NH 03458.

73 Amateur Radio's Technical Journal

80 Pine Street Peterborough, NH 03458

800-343-0728

MAKE SAVING MONEY A WAY OF LIFE

With **LIVING ON A SHOESTRING:** A Scrounge Manual for the Hobbyist. Almost anything you find can be put to good use if you follow the techniques of a master scrounger. George Ewing WA8WTE shows you how to:

- Find electronic parts
- Locate tools and other surplus
- Scrounge by the rules
- Read up on scrounging
- Scrounge a vehicle
- Scrounge a place to live

Cartoons and case histories of scroungers add a humorous touch. With **LIVING ON A SHOESTRING**, you can't always get something for nothing, but you can certainly get it for less. $7.97 Softcover, 7×9, 128 pp. approx., ISBN 0-88006-059-X

Call TOLL FREE 1-800-258-5473 for credit card orders. Or mail your order with payment or complete credit card information. Include $1.50 for shipping and handling. Send to:

Wayne Green Inc.
Attn: Book Sales
Peterborough, NH 03458

A Wayne Green Publication — Dealer Inquiries Invited

YES, I want to scrounge! 339B6L

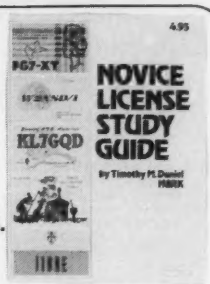
Send me ____ copies of **LIVING ON A SHOESTRING**. Enclosed is $7.97 (BK7393) per copy plus $1.50 shipping and handling.

☐ MASTERCARD bank # _____ ☐VISA ☐ AMEX
Card # _____ Expires _____
Signature _____
Name _____
Address _____
City _____ State and Zip _____

RADIO BOOKSHOP

FOR THE NOVICE

New, updated editions of our famous novice license study guide and novice study tapes.



● **NOVICE LICENSE STUDY GUIDE**—by Timothy M. Daniel N8RK. Here is the most up to date novice guide available. It is complete with information about learning Morse Code, has the latest FCC amateur regulations and the current FCC application forms. This guide *is not* a question/answer memorization course but rather it emphasizes the practical side of getting a ham license and putting a station on the air. It reflects what the FCC expects a Novice to know without page after page of dull theory. The most current information still available at last year's price. SG7357 $4.95.*

● **NOVICE STUDY TAPES**—If you are just getting started in ham radio, you'll find these tapes indispensable! This up-to-the-minute revision of the 73 Study Course is the perfect way to learn everything you need to breeze through the Novice written exam. Theory, FCC regulations, and operating skills are all covered, and you'll be amazed at how fast you learn using these tapes!

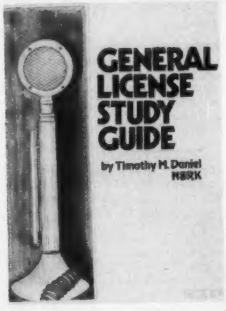
Once the test is behind you, these tapes will go right on being useful, because they are packed with the latest information on setting up your own ham station, and getting on the air.

Thousands of people have discovered how easy learning from cassette can be—order now and enter the fascinating world of ham radio! CT7300 Set of 3—$15.95.*

Scientists have proven that you learn faster by listening than by reading because you can play a cassette tape over and over in your spare time—even while you're driving! You get more and more info each time you hear it. You can't progress without solid fundamentals. These three hour-long tapes give you all the basics you'll need to pass the Novice exam easily. You'll have an understanding of the basics which will be invaluable to you for the rest of your life! Can you afford to take your Novice exam without first listening to these tapes?

Special Offer! Both Novice License Study Guide and Novice Study Tapes $19.95 Order NP7300.

GENERAL LICENSE STUDY GUIDE



GENERAL LICENSE STUDY GUIDE—By Timothy M. Daniel N8RK This is the complete guide to the General License. Learning rather than memorizing is the secret. This is not a question-and-answer guide that will gather dust when the FCC issues a new test. Instead, this book will be a helpful reference, useful long after a ham upgrades to General. Includes up-to-date FCC rules and an application form. Order yours today and talk to the world. SG7358 $6.95

Style W

Style Y

Style X

● **QSL CARDS**—*73* turns out a fantastic series of QSL cards at about half the cost of having them done elsewhere because they are run as a fill-in between printing books and other items in the 73 Print Shop. 250 Style W—QW0250—for $8.95*; 500 Style W—QW0500—for $13.95*; 250 Style X—QX0250—for $8.95*; 500 Style X—QX0500; 250 Style Y—QY0250—for $8.95*; 500 Style Y—QY0500—for $13.95.* Allow 6-12 wks. for delivery.

LIBRARY SHELF BOXES—These sturdy white corrugated, dirt boxes each hold a full year of *73, Microcomputing or 80 Micro Desktop Computing, inCider.* With your order, request self-sticking labels for any of the following: *73, Microcomputing, 80 Micro, CQ, QST, Ham Radio Personal Computing, Radio Electronics, Interface Age, and Byte.* Order 1—BX1000—for $2.00*; order 2-7—BX2002—for $1.50 each*; order 8 or more—BX1002—for $1.25 each*.

For Your Ham Shack 73 Magazine Binders

● Preserve and protect your collection for a lifetime! Order these handsome red binders with gold lettering. $7.50 for 1, 3 for $21.75, 6 for $42.00. (Postpaid within USA, please add $2.50 per order outside USA.) *Check or money orders only, no phone or C.O.D. orders.* **73 Binders, P.O. Box 5120, Philadelphia, PA 19141.**

***NOTE—Above address for Binders only.**

73 Code Tapes

any four tapes for $15.95! $4.95 each

"GENESIS"

5 WPM—CT7305—This is the beginning tape for people who do not know the code at all. It takes them through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way using the newest blitz teaching techniques. It is almost miraculous! In one hour many people—including kids of ten—are able to master the code. The ease of learning gives confidence to beginners who might otherwise drop out.

"THE STICKLER"

6+ WPM—CT7306—This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly—under pressure—faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five.

"BACK BREAKER"

13+ WPM—CT7313—Code groups again, at a brisk 14 per so you will be at ease when you sit down in front of the steely-eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test, you'll thank heaven you had this back-breaking tape.

"COURAGEOUS"

20+ WPM—CT7320—Code is what gets you when you go for the Extra class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape.

"OUTRAGEOUS"

25+ WPM—CT7325—This is the tape for that small group of overachieving hams who wouldn't be content to simply satisfy the code requirements of the Extra Class license. It's the toughest tape we've got and we keep a permanent file of hams who have mastered it. Let us know when you're up to speed and we'll inscribe your name in 73's CW "Hall of Fame."

BACK ISSUES—Complete your collection; many are prime collectables now, classics in the field! A full collection is an invaluable compendium of radio and electronics knowledge!

73300	73 BACK ISSUE—BEFORE JULY 1980	$ 3.00
73350	73 BACK ISSUE JULY 1980 THRU OCT. 1981	$ 3.50
73350P	73 BACK ISSUE NOV. 1981 TO PRESENT	$ 3.50
73005	73 BACK ISSUE—5 YOUR CHOICE	$10.75
73010	73 BACK ISSUE—10 YOUR CHOICE	$16.00
73025	73 BACK ISSUE—25 YOUR CHOICE	$27.00
73125	73 BACK ISSUE—25 OUR CHOICE	$14.00

Shipping: Please add $1.00 per magazine. Orders of ten magazines or twenty-five magazines add $7.50 per order.

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop ● Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. $1.50 for the first book, $1.00 each additional book for U.S. delivery and foreign surface. For foreign airmail $10.00 per book. Please allow 4-6 weeks for delivery. Questions regarding your order? Please write to Customer Service at the above address. (Prices subject to change on books not published by 73 Magazine.)

FOR TOLL FREE ORDERING CALL 1-800-258-5473

RADIO BOOKSHOP

HAND BOOKS FOR NEW! THE HAMSHACK

AMATEUR RADIO CALL DIRECTORY, 1982-1983 Edition. Compiled by: Jack A. Speer N1BIC and Ashok K. Anand. Here it is, and at a price you can afford! A directory of over 410,000 radio amateurs in the United States (as licensed by the U.S. Gov't). Completely updated for 1983. Easy to handle 8½ x 11 format. BK1254 $14.95

THE TEN METER FM HANDBOOK—by Bob Heil K9EID. This handbook has been published to help the ten meter enthusiast learn more about the many methods of conversions and tricks that are used to make existing units work better. Join the great "tinkerers" of the world on ten FM and enjoy the fantastic amount of fun in communicating with amateur stations worldwide on ten meter FM. BK1190 $4.95.*

THE COMPLETE SHORTWAVE LISTENER'S HANDBOOK, 2nd EDITION by Hank Bennett and Harry L. Helms. This comprehensive volume contains loads of new information from all over the world on the latest developments in SWL technology clubs, associations, practices and stations. A thorough guide to stations of the world by general continental area and frequency is included. BK1241 $9.95

THE PRACTICAL HANDBOOK OF AMATEUR RADIO FM REPEATERS—by Bill Pasternak WA6ITF (author of 73 Magazines monthly column "Looking West") This is the book for the VHF/UHF FMer, compiled from material submitted by over a hundred individuals, clubs, organizations and equipment manufacturers. A "must have" for your ham shack shelf. BK1185 $12.95.*

THE 73 TEST EQUIPMENT LIBRARY

VOL. II AUDIO FREQUENCY TESTERS—Jam-packed with all kinds of audio frequency test equipment. If you're into SSB, RTTY, SSTV, etc., this book is a must for you. . . a good book for hi-fi addicts and experimenters, too! LB7360 $1.95.*

VOL. III RADIO FREQUENCY TESTERS—Radio frequency waves, the common denominator of amateur radio. Such items as SWR, antenna impedance, line impedance, RF output, and field strength; detailed instructions on testing these items includes sections on signal generators, crystal calibrators, grid dip oscillators, noise generators, dummy loads, and much more. LB7361 $1.95.*

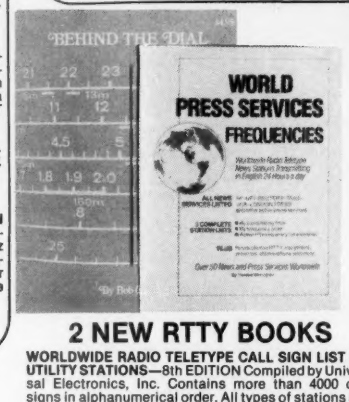
VOL. IV IC TEST EQUIPMENT—Become a troubleshooting wizard! Here are 42 home construction projects for building test equipment to work with your ham station and in servicing digital equipment. Plus a cumulative index for all four volumes for the 73 TEST EQUIPMENT LIBRARY. LB7362 $1.95.*

ALL THREE OF THE ABOVE ONLY $4.95 ORDER LB7365

RF AND DIGITAL TEST EQUIPMENT YOU CAN BUILD—BK1044—Rf burst, function, square wave generators, variable length pulse generators—100 kHz marker, i-f and rf sweep generators, audio osc, af/rf signal injector, 146 MHz synthesizer, digital readouts for counters, several counters, prescaler, microwave meter, etc. 252 pages. BK1044 $5.95.*

FOR THE CONTESTER

THE CONTEST COOKBOOK—This book reveals the secrets of that elite group of operators who top the list when the contest results are published. It contains detailed suggestions for the first-time contester as well as tips for the advanced operator. Domestic, DX, and specialty contests are all discussed, complete with photographs and diagrams showing the equipment and operating aids used by the top scorers. For the serious contester. BK7308 $5.95.



2 NEW RTTY BOOKS

WORLDWIDE RADIO TELETYPE CALL SIGN LIST OF UTILITY STATIONS—8th EDITION Compiled by Universal Electronics, Inc. Contains more than 4000 call signs in alphanumerical order. All types of stations are listed. 183 utility station mnemonics and name abbreviations. Plus abbreviations for regional states in Australia, Canada, USA and USSR. All ITU Symbols designating countries or geographical areas. Table of allocation of international call sign series. Revised radio regulations on indentification of stations, including formation or call signs. All services listed. BK1271 $4.95

70 YEARS OF RADIO TUBES AND VALVES—by John Stokes "Great, the best book on the history of radio tubes that I've *ever* seen!" raved 73's technical editor. Written by an expert who has been involved in radio since '29, this book will be of special interest to "old-timers" and will provide those younger hams with a unique sense of the history of their hobby. BK1272 $21.95

WORLD WIDE RADIO TELETYPE STATIONS IN FREQUENCY ORDER—8th EDITION Compiled by Universal Electronics, Inc. Contains 2198 frequencies of stations that have been logged in 1982. Frequency, call sign, name of station, ITU country symbol, times of reception and details are included. All types of RTTY stations are listed including schedules of 82 press and news agencies operating on 637 frequencies. Includes 77 meteorological stations on 279 frequencies. Covers all RTTY stations from 3 MHZ to 30 MHZ, air, metro, government, military, diplomatic, covers all services. This is the most accurate RTTY list there is and a must for the serious RTTY enthusiast. BK1270 $10.95.

EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT AMATEUR TELEVISION, (but were afraid to ask)—By Mike Stone WB0QCD. This book is a complete guide to setting up your own amateur radio television station. It contains—A history, what equipment you need, video theory, cameras, recorders, lighting, special effects, sound ATV DXing, mobile FSTV, ATV repeaters, ATV groups, building projects, test equipment, dealer directory, a cumulative index of over 1000 articles on amateur TV and much more. **This is the new, 1982 edition.** From the publishers of *Amateur Television Magazine.* BK1244 $9.95

WORLD PRESS SERVICE FREQUENCIES—by Thomas Harrington Can't wait to hear the evening news, or are you wondering about the news that you *aren't* hearing? Receive by Radio Teletype (RTTY) *all* the world news and financial happenings from the world capitols on a 24 hour a day basis. This book gives you the frequencies and times of broadcast of such news services as AP, UPI, Reuters, TASS, VOA and London Press. Also included is an introduction to RTTY with information on equipment, antennas, abbreviations—everything you need to get started in RTTY. BK1202 $7.95*

THE 73 TECHNICAL LIBRARY

TOOLS & TECHNIQUES FOR ELECTRONICS—by A. A. Wicks is an easy-to-understand book written for the beginning kit-builder as well as the experienced hobbyist. It has numerous pictures and descriptions of the safe and correct ways to use basic and specialized tools for electronic projects, as well as specialized metal-working tools and the chemical aids which are used in repair shops. BK7348 $4.95.*

BEHIND THE DIAL—This book explains, in detail, what's going on on all the frequencies, from shortwave up to microwave. It gives the reader a good idea of what he can find and where to find it, including some of the secret stations such as the C.I.A. and the F.B.I. Everything is covered short of microwave monitoring. Anyone interested in purchasing a shortwave receiver should have a copy of this book. surveillance, station layout consideration, antenna systems, interface, and the electromagnetic spectrum. are included. BK7307 $4.95

THE NEW WEATHER SATELLITE HANDBOOK—by Dr. Ralph E. Taggart WB8DQT. Here is the completely updated and revised edition containing all the information on the most sophisticated and effective spacecraft now in orbit. This book serves both the experienced amateur satellite enthusiast and the newcomer. It is an introduction to satellite watching, providing all the information required to construct a complete and highly effective ground station. Solid hardware designs and all the instructions necessary to operate the equipment are included. For experimenters who are operating stations, the book details all procedures necessary to modify equipment for the new series of spacecraft. Amateur weather satellite activity represents a unique blend of interests encompassing electronics, meteorology and astronautics. Join the privileged few in watching the spectacle of earth as seen from space on your own monitoring equipment. BK7383 $8.95.*

PROPAGATION WIZARD'S HANDBOOK— by J. H. Nelson. When sunspots riddled the worldwide communications networks of the 1940s, John Henry Nelson looked to the planets for an answer. The result was a theory of propagation forecasting based upon interplanetary alignment that made the author the most reliable forecaster in America today. The book provides an enlightened look at communications past, present, and future, as well as teaching the art of propagation forecasting. BK7302 $6.95.*

SSB . . . THE MISUNDERSTOOD MODE—by James B. Wilson. Single Sideband Transmission . . . thousands of us use it every day, yet it remains one of the least understood facets of amateur radio. J. B. Wilson presents several methods of sideband generation, amply illustrated with charts and schematics, which will enable the ambitious reader to construct his own sideband generator. A must for the technically-serious ham. BK7351 $5.50.*

INTERFERENCE HANDBOOK—by William R. Nelson, WA6EQG—This timely handbook covers every type of RFI problem and gives you the solutions based on practical experience. Covers interference to TV, radio, hi-fi, telephone, radio amateur, commercial and CB equipment. Power line interference is covered in depth —how to locate it, cure it, work with the public, safety precautions, how to train RF/I investigators. Written by an RFI expert with 33 years of experience, this profusely illustrated book is packed with practical easy-to-understand information. BK1230 $11.95

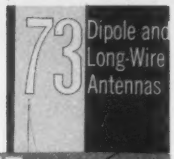
OWNER REPAIR OF RADIO EQUIPMENT—by Frank Glass K6RQ. Here's a book that will teach you an approach to troubleshooting without a shack full of test equipment. Written in a narrative, non-mathematical style, it will encourage you to successfully fix your own rig problems 80 to 90% of the time. Even if you don't want to fix, you can learn a lot about how things work and fail. Add to your library and personal expertise. BK7310 $7.95.*

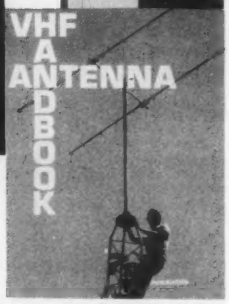
*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop ● Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. $1.50 for the first book, $1.00 each additional book for U.S. delivery and foreign surface. For foreign airmail $10.00 per book. Please allow 4–6 weeks for delivery. Questions regarding your order? Please write to Customer Service at the above address. (Prices subject to change on books not published by 73 Magazine.)

FOR TOLL FREE ORDERING CALL 1-800-258-5473

RADIO BOOKSHOP

ANTENNA BOOKS





VHF ANTENNA HANDBOOK—The new *VHF Antenna Handbook* details the theory, design, and construction of hundreds of different VHF and UHF antennas. . . a practical book written for the average amateur who takes joy in building, not full of complex formulas for the design engineer. Packed with fabulous antenna projects you can build. BK7368 $5.95.*

ALL ABOUT CUBICAL QUAD ANTENNAS (2nd edition)—The "Classic" on Quad design, theory, construction, and operation. New 2nd edition contains new feed and matching systems and new data. BK1196 $6.95.

THE RADIO AMATEUR ANTENNA HANDBOOK—All about wire antennas, beams, tuners, baluns, coax, radials, SWR and towers. Clear and complete information. BK1199 $7.95

SIMPLE, LOW-COST WIRE ANTENNAS FOR RADIO AMATEURS—All new data and everything you want to know about low-cost, multi-band antennas, inexpensive beams, "invisible" antennas for hams in "tough" locations. BK1200 $7.95

BEAM ANTENNA HANDBOOK (New 5th edition)—by William I. Orr & Stuart D. Cowan. Yagi beam theory, construction and operation. Information on wire beams, SWR curves and matching systems. A "must" for serious DXers. BK1197 $7.95.

RADIO ANTENNAS—by Stephen Gibson. A complete introduction to radio antennas for the amateur radio operator. Clearly written and fully illustrated with diagrams and photographs, *Radio Antennas* makes an excellent resource book. It covers the various types of antennas and how to design, construct, and erect them. Antenna testing, measuring instruments and techniques, and possible sources of supply components are also discussed. In addition, *Radio Antennas* provides a thorough background in propagation theory. BK1287 softcover 6 by 9 165 pp. ISBN 0-8359-6358-6 Reston Publishing Co., Inc. 1983.

73 DIPOLE AND LONG-WIRE ANTENNAS—by Edward M. Noll W3FQJ. This is the first collection of virtually every type of wire antenna used by amateurs. Includes dimensions, configurations, and detailed construction data for 73 different antenna types. Appendices describe the construction of noise bridges, line tuners, and data on measuring resonant frequency, velocity factor, and swr. BK1016 $5.50.*

COOK BOOKS

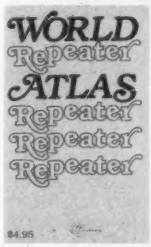
TTL COOKBOOK—by Don Lancaster. Explains what TTL is, how it works, and how to use it. Discusses practical applications, such as a digital counter and display system, events counter, electronic stopwatch, digital voltmeter and a digital tachometer. BK1063 $9.50.*

CMOS COOKBOOK—by Don Lancaster. Details the application of CMOS, the low power logic family suitable for most applications presently dominated by TTL. Required reading for every serious digital experimenter! BK1011 $10.50.*

TVT COOKBOOK—by Don Lancaster. Describes the use of a standard television receiver as a microprocessor CRT terminal. Explains and describes character generation, cursor control and interface information in typical, easy-to-understand Lancaster style. BK1064 $9.95.*

IC OP-AMP COOKBOOK—by Walter G. Jung. Covers not only the basic theory of the IC op amp in great detail, but also includes over 250 practical circuit applications, liberally illustrated. 592 pages, 5½ × 8½, softbound. BK1028 $14.95.*

THE WELL EQUIPPED HAM SHACK



RADIO ELECTRONICS BUYER'S GUIDE. Locate all the parts you need. This guide can be used to locate a wide variety of parts, which are listed alphabetically, giving numbers, descriptions and suppliers. Supplier information includes the supplier's address and phone number, cost to obtain a catalog, minimum order information and whether their parts are new or surplus. BK1288 $4.95 softcover 6 by 9 95 pp. Hallward Products 1983.

WORLD REPEATER ATLAS—Completely updated, over 230 pages of repeater listings are indexed by location and frequency. More than 50 maps pinpoint 2000 repeater locations throughout the USA. Foreign listings include Europe, the Middle East, South America, and Africa. BK7315 $2.00

THE MAGIC OF HAM RADIO—by Jerrold Swank W8HXR. Under various callsigns, W8HXR has been heard on the ham bands since 1919. He has watched amateur radio grow from the days of Model A spark coils to an era of microprocessors and satellite communications. Jerry has responded to calls for help from earthquake-striekn Managua and tornado-ravaged Xenia. Antarctica, one of man's loneliest outposts, has been a bit less lonely, thanks to Jerry's tireless phonepatching efforts. Drawing on his own colorful experiences and those of many other hams, Jerry has compiled this wordpicture of ham radio during the past six decades. BK7312 $4.95

A GUIDE TO HAM RADIO—by Larry Kahaner WB2NEL. What's Amateur Radio all about? You can learn the basics of this fascinating hobby with this excellent beginner's guide. It answers the most frequently asked questions in an easy-going manner, and it shows the best way to go about getting an FCC license. A Guide to Ham Radio is an ideal introduction to a hobby enjoyed by people around the world. BK7321 $4.95.*

WORLD RADIO TV HANDBOOK 1983, 26TH EDITION—This book is the bible of international broadcasters, providing the only authoritative source of exact information about broadcasting and TV stations world wide. This 1983 edition is completely revised, giving comprehensive coverage of short, medium and long wave, 560 pages of vital aspects of world listening. BK1184 $16.50

HOW TO DEFEND YOURSELF AGAINST RADAR—by Bruce F. Bogner and James R. Bodnar, a lawyer and radar expert. This book gives you the ammunition to challenge the radar "evidence" that usually leads to a speeding conviction. The major part of the book details the inner workings of radar—you'll become more of an expert than most police officers and judges. The remainder of the book outlines how to defend yourself against a speeding ticket—the observations, measures and testimony you must obtain to defend yourself without the help of a lawyer. The price is a lot less than a fine! BK1201 $6.95.*

MICROCOMPUTER BOOKS

THE SELECTRIC INTERFACE—by George Young. You need the quality print that a daisy wheel printer provides but the thought of buying one makes your wallet wilt. SELECTRIC™ INTERFACE, a step-by-step guide to interfacing an IBM Selectric I/O Writer to your microcomputer, will give you that quality at a fraction of the price. George Young, co-author of *Kilobaud Microcomputing* magazine's popular "Kilobaud Klassroom" series, offers a low-cost alternative to buying a daisy wheel printer. SELECTRIC INTERFACE includes: step-by-step instructions, tips on purchasing a used Selectric, information on various Selectric models, including the 2740, 2980, and Dura 1041, driver software for Z80, 8080, and 6502 chips, tips on interfacing techniques. With SELECTRIC INTERFACE and some background in electronics, you can have a high-quality, low-cost, letter-quality printer. Petals not included. BK7388 $12.97

40 COMPUTER GAMES FROM KILOBAUD MICROCOMPUTING—Forty games in nine different categories. Games for large and small systems, and a section on calculator games. Many versions of BASIC used and a wide variety of systems represented. A must for the serious computer gamesman. BK7381 $7.95*

KILOBAUD KLASSROOM—By George Young and Peter Stark. Learning electronics theory without practice isn't easy. And it's no fun to build an electronics project that you can't use. *Kilobaud Klassroom* the popular series first published in *Kilobaud Microcomputing*, combines theory with practice. This is a *practical* course in digital electronics. It starts out with very simple electronics projects, and by the end of the course you'll construct your own working microcomputer! BK7386 $14.95

TEXTEDIT—A Complete Word Processing System in kit form—by Irwin Rappaport. *TEXTEDIT* is an inexpensive word processor that you can adapt to suit your needs, from writing form letters to large texts. It is written in modules, so you can load and use only those portions that you need. Included are modules that perform right justification, ASCII upper/lowercase conversion, one-key phrase entering, complete editorial functions, and much more! *TEXTEDIT* is written in TRS-80* Disk BASIC, and the modules are documented in the author's admirably clear tutorial writing style. Not only does Irwin Rappaport explain how to use *TEXTEDIT*; he also explains programming techniques implemented in the system. *TEXTEDIT* is an inexpensive word processor that helps you learn about BASIC programming. It is written for TRS-80 Models I and III with TRSDOS 2.2/2.3 and 32K. *TRS-80 and TRSDOS are trademarks of the Radio Shack Division of Tandy Corporation. BK7387 $9.97

COMPUTER CARNIVAL—by Richard Ramella. Your child can become a crackerjack computerist with the sixty TRS-80 Level II programs in COMPUTER CARNIVAL. This large-type, spiral bound book for beginners is a veritable funhouse of games, graphics, quizzes and puzzles. Written by *80 Micro* columnist Richard Ramella, the programs are challenging enough to ensure continued learning, yet short enough to provide your child with the immediate delight and reward of mastering basic computing skills. And for even greater enjoyment, get the CARNIVAL COMPANION, a 30-minute cassette containing all the programs in the book. Eliminates tiresome typing and lets your child spend more time enjoying the programs. BK7389 $16.97 CC7389 Book and Cassette $24.97

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to: 73 Radio Bookshop ● Peterborough NH 03458. Be sure to include check or detailed credit card information. No C.O.D. orders accepted. $1.50 for the first book, $1.00 each additional book for U.S. delivery and foreign surface. For foreign airmail $10.00 per book. Please allow 4–6 weeks for delivery. Questions regarding your order? Please write to Customer Service at the above address. (Prices subject to change on books not published by 73 Magazine.)

FOR TOLL FREE ORDERING CALL 1-800-258-5473

ADVERTISERS

*Please contact these advertisers directly.
To receive full information from our advertisers please complete the postage-paid card.

R.S. No.		Page
*	AEA/Advanced Electronic Applications	33
448	Advanced Communications International	117
124	Advanced Computer Controls	14
216	Alden Electronics	25
20	All Electronics	115
43	Alternative Energy Engineering	123
*	Amateur Communications, Etc.	47
*	Amateur Electronic Supply	37
75	Ampersand Electronics	88
71	Applied Invention	51
*	Associated Radio	83
483	BHC, Inc.	107
70	B&D Microenterprises, Inc.	32
11	Barker & Williamson, Inc.	67
305	Barry Electronics	31
492	Beale Electronics	108
26	Bee Computers	123
*	Bill Ashby & Son	115
*	Blacksburg Group	109
226	Buckmaster Publishing	51
255	Buckmaster Publishing	121
*	Butternut Electronics Corp.	51
53	California Antenna Systems	122
7	Ceco Communications, Inc.	56
13	Coin International, Inc.	123
488	Commsoft	96
14	Communications Concepts, Inc.	49
382	Communications Concepts, Inc.	103
462	Communications Electronics Specialties, Inc.	9
15	Communications Specialists, Inc.	71
34	Communications Specialists, Inc.	79
*	*Computer Trader*	123
37	Contemporary Technology, Inc.	45
491	Contemporary Technology, Inc.	108
25	Control Products Unlimited	88
21	Current Development Corp.	56
106	Cushcraft Corp.	80
12	C. Z. Labs, Inc.	97
*	Datalog	122
346	Data Service Company	121
*	DGM Electronics, Inc.	56
425	Doppler Systems	115
*	Drake Co., R. L.	90
219	E-Tek	123
58	Electronic Rainbow Industries, Inc.	45
73	Electronic Rainbow Industries, Inc.	119
18	Electronic Specialists, Inc.	55
*	Elmira Hamfest	120
29	Esoteric Engineering	123
248	Etco Electronics	87
22	Fair Radio Sales	123
85	Faxscan, Inc.	57
218	Ferritronics	45
23	Flesher Corp.	57
479	Flesher Corp.	106
8	Fox-Tango Corp.	82
323	Fox-Tango Corp.	115
178	Galaxy Electronics	122
229	Gizmo Electronics	121
143	GLB Electronics	99
345	Hal Communications	11
31	Hal-Tronix	32
*	Ham Radio Center	5
*	Ham Radio Outlet	3
33	Hamtronics, NY	142, 143
489	Heath	94
59	Heil Sound, Ltd.	47
476	Heil Sound, Ltd.	107
*	High Tech-W	87
*	Hustler, Inc.	82, 108
*	ICOM	Cov. II, 106
78	Independent Crystal Supply	122
482	Industrial Computer Designs	107
36	International Crystal	82
*	iRL	10
39	Jan Crystal	57
*	Japan Radio	18
478	Jim Grubbs	108
*	Kantronics	26, 27
230	KCS Electronics Corp.	97
*	Kenwood	7, Cov. IV
*	KLM Electronics	4
322	Larsen Antennas	23
*	Lee-Art, Inc.	122
220	Lunar Electronics	122
236	Macaw Electronics	118
*	Macrotronics, Inc.	99
45	Madison Electronics	35
484	Magnum Distributing	107
9	MFJ Enterprises	77
233	MFJ Enterprises	115
234	MFJ Enterprises	117
260	MFJ Enterprises	119
48	MHz Electronics	124–133
240	Mi-Tronix	99
27	Micro-80, Inc.	82
49	Micro Control Specialties	39
477	Microfish Software Products	106
41	Microlog Corporation	43
51	Microlog Corporation	16, 17
*	Mirage Communications	75
258	Missouri Radio Center	12
254	National Comm. Group Co.	97
412	Nemal Electronics	121
137	*Nuts & Volts*	122
*	*Orbit* Magazine	109
*	P. C. Electronics	15
4	Parsec Communications	65
246	Phillips-Tech Electronics Corp.	97
61	Radio Amateur *Callbook*, Inc.	80
397	Radio World	140
69	Radiokit	48
62	Ramsey Electronics	141, 145
133	Rivendell Associates	97
150	Royal	123
65	S-F Amateur Radio Services	140
500	*73*	
	Books	101, 109–114, 121, 140
	Dealer Ad	110
	Moving	110
	Subscriptions	67, 81, 121
	Universal Microfilms	121
*	Spectronics	144
68	Spectrum Communications	68, 69
436	Spectrum International, Inc.	83
3	Speedcall Corp.	49
173	Spider Antenna	57
183	Tayco Communications	122
32	TE Systems	51
*	Ten-Tec	73
245	TET/Sultronics	87
63	The Antenna Specialists	13
46	The Ham Shack	33
449	The Ham Shack	117
205	The Metheny Corp.	14
76	Trac Electronics	80
104	Trionyx	83
481	Ungar	107
490	Universal Software	90
*	V-J Products, Inc.	13
*	Van Gorden Engineering	49
311	Vanguard Labs	121
90	Vocom Products	47
*	W9INN Antennas	120
486	W. H. Nail Co.	95
244	W. H. Nail Co.	140
*	Westcom	119
80	Western Radio Electronics	122
83	Yaesu Electronics	Cov. III

73

BOOKS, ETC.

To order, complete the postage-paid card, or itemize your order including detailed credit card information or check and mail to: 73 Magazine/Mail Order Dept./Peterborough NH 03458.

Catalog#	Item	Price
73300	73 BACK ISSUE – BEFORE JULY 1980	$ 3.00
73350	73 BACK ISSUE – JULY 1980 THRU OCT 1981	$ 3.50
73350P	73 BACK ISSUE – NOV 1981 TO PRESENT	$ 3.50
73005	73 BACK ISSUE – 5 YOUR CHOICE	$10.75
	Add $1.00 per magazine for shipping	
73010	73 BACK ISSUE – 10 YOUR CHOICE	$16.00
73025	73 BACK ISSUE – 25 YOUR CHOICE	$27.00
73125	73 BACK ISSUE – 25 OUR CHOICE	$14.00
	Add $7.50 per order for shipping	
BK1196	ALL ABOUT CUBICAL QUAD ANTENNAS	$ 5.95
BK7384	ANNOTATED BASIC VOL 1	$10.95
BK7385	ANNOTATED BASIC VOL 2	$10.95
BK1197	BEAM ANTENNA HANDBOOK	$ 5.95
BK7307	BEHIND THE DIAL	$ 4.95
BK7309	CHALLENGE OF 160	$ 4.95
BK1011	CMOS COOKBOOK	$10.50
CT7305	CODE TAPE – 5 WPM	$ 4.95
CT7306	CODE TAPE – 6 + WPM	$ 4.95
CT7313	CODE TAPE – 13 + WPM	$ 4.95
CT7320	CODE TAPE – 20 + WPM	$ 4.95
CT7325	CODE TAPE – 25 + WPM	$ 4.95
CT7394	CODE TAPES (ANY FOUR ABOVE)	$15.95
BK1241	THE COMPLETE SHORTWAVE LISTENER'S HANDBOOK	$ 9.95
BK7308	THE CONTEST COOKBOOK	$ 5.95
BK7381	40 COMPUTER GAMES	$ 7.95
BK1244	EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT AMATEUR TV	$ 9.95
BK7321	A GUIDE TO HAM RADIO	$ 4.95
BK7322	HOBBY COMPUTERS ARE HERE	$ 2.47
BK1201	HOW TO DEFEND YOURSELF AGAINST RADAR	$ 6.95
BK1028	IC OP AMP COOKBOOK	$14.95
BK1230	INTERFERENCE HANDBOOK	$ 8.95
BK7386	KILOBAUD KLASSROOM	$14.95
BK7312	MAGIC OF HAM RADIO	$ 4.95
BK7340	THE NEW HOBBY COMPUTERS	$ 2.47
BK7383	THE NEW WEATHER SATELLITE HANDBOOK	$ 8.95
CT7300	NOVICE THEORY TAPES	$15.95
BK7310	OWNER REPAIR OF RADIO EQUIPMENT	$ 7.95
BK1185	THE PRACTICAL HANDBOOK OF FM REPEATERS	$12.95
BK7302	PROPAGATION WIZARD'S HANDBOOK	$ 6.95
QW0250	QSL CARDS – STYLE W – 250	$ 8.95
QW0500	QSL CARDS – STYLE W – 500	$13.95
QX0250	QSL CARDS – STYLE X – 250	$ 8.95
QX0500	QSL CARDS – STYLE X – 500	$13.95
QY0250	QSL CARDS – STYLE Y – 250	$ 8.95
QY0500	QSL CARDS – STYLE Y – 500	$13.95
BK1199	THE RADIO AMATEUR ANTENNA HANDBOOK	$ 6.95
BK1044	RF & DIGITAL TEST EQUIPMENT	$ 5.95
BK1016	73 DIPOLE & LONG WIRE ANTENNAS	$ 5.50
BX1000	SHELF BOX – 1	$ 2.00
BX1001	SHELF BOXES – 2 7	$1.50 each
BX1002	SHELF BOXES – 8 AND UP	$1.25 each
BK1200	SIMPLE LOW COST WIRE ANTENNAS FOR RADIO AMATEURS	$ 6.95
BK7311	SOME OF THE BEST FROM KILOBAUD	$10.95
BK7351	SSB THE MISUNDERSTOOD MODE	$ 5.50
SG7357	STUDY GUIDE – NOVICE CLASS	$ 4.95
SG7358	STUDY GUIDE – GENERAL CLASS	$ 6.95
BK1190	THE TEN METER FM HANDBOOK	$ 4.95
LB7360	TEST EQUIP LIB V2 – AUDIO TESTERS	$ 4.95
LB7361	TEST EQUIP LIB V3 – RADIO EQUIP	$ 4.95
LB7362	TEST EQUIP LIB V4 – IC TEST EQ	$ 4.95
BK7387	TEXTEDIT – WORD PROCESSING KIT	$9.97
DS7387	TEXTEDIT – DISK	$19.97
BK7348	TOOLS & TECHNIQUES	$ 4.95
BK1063	TTL COOKBOOK	$ 9.50
BK1064	TVT COOKBOOK	$ 9.95
BK7382	UNDERSTANDING & PROGRAMMING MICROCOMPUTERS	$10.95
BK7368	VHF ANTENNA HANDBOOK	$ 5.95
BK1198	VHF HANDBOOK FOR RADIO AMATEURS	$ 6.95
BK1202	WORLD PRESS SERVICE FREQUENCIES	$ 7.95
BK1184	WORLD RADIO TV HANDBOOK	$16.50
BK7315	WORLD REPEATER ATLAS	$ 2.00

SHIPPING AND HANDLING CHARGES: $1.50 for the first book, $1 for each additional book for US delivery and foreign surface. $10 per book for foreign airmail.

NEW TS830S for $150?

Yes indeed! Just add a Matched Pair of top-quality 2.1KHz BW (bandwidth) Fox Tango Filters. Here are a few quotes from users:

"... Makes a new rig out of my old TS830S! ..."
"...VBT now works the way I dreamed it should..."
"...Spectacular improvement in SSB selectivity..."
"...Completely eliminates my need for a CW filter..."
"...Simple installation - excellent instructions..."

The Fox Tango filters are notably superior to both original 2.7KHz BW units but especially the modest ceramic 2nd IF; our substitutes are 8-pole discrete-crystal construction. The comparative FT vs Kenwood results? VBT OFF — RX BW: 2.0 vs 2.4; Shape Factor: 1.19 vs 1.34; 80dB BW: 2.48 vs 3.41; Ultimate Rejection: 110dB vs 80. VBT SET FOR CW at 300Hz BW — SF 2.9 vs 3.33; Insertion Loss: 1dB vs 10dB.

AND NOW A NEW TS 930S!
Tests prove that the same filters improve the '930 even more than our '830. Don't buy CW filters—not even ours. You probably won't need them!

INTRODUCTORY PRICE: (Complete Kit)...$150
Includes Matched Pair of Fox Tango Filters, all needed cables, parts, detailed instructions. Specify kit desired: FTK-830 or FTK-930.
Shipping $3 (Air $5). FL Sales Tax 5%

ONE YEAR WARRANTY
GO FOX-TANGO – TO BE *SURE!*
Order by Mail or Telephone.
AUTHORIZED EUROPEAN AGENTS
Scandinavia MICROTEC (Norway)
Other: INGOIMPEX (West Germany)

FOX TANGO CORPORATION
Box 15944S, W. Palm Beach, FL 33406
Phone: (305) 683-9587 ↙323

TOLL FREE ORDERS • 1-800-826-5432
(IN CALIFORNIA: 1-800-258-6666)
AK, HI OR INFORMATION • (213) 380-8000

5 KEY ASSEMBLY $1.00 EACH
CONTAINS 5 SINGLE-POLE NORMALLY OPEN SWITCHES. MEASURES 3 3/4" LONG.

6 KEY ASSEMBLY $1.25 EACH
CONTAINS 6 SINGLE-POLE NORMALLY OPEN SWITCHES. MEASURES 4 1/4" LONG.

120V INDICATOR
NEON INDICATOR. RATED 120 V 1/3 W. MOUNTS IN 5/16" HOLE . . . . RED LENS.
75¢ EACH
10 FOR $7.00
100 FOR $65.00

MINIATURE 6 VDC RELAY
SUPER SMALL SPDT RELAY; GOLD COBALT CONTACTS. RATED 1 AMP AT 30 VDC; HIGHLY SENSITIVE, TTL DIRECT DRIVE POSSIBLE, OPERATES FROM 4.3 TO 6 V. COIL RES. 220 OHM. 1 3/16" × 13/32" × 7/16"
AROMAT # RSD-6V
$1.50 EACH
10 FOR $13.50

13 VDC RELAY
CONTACT: S.P.N.C. 10 AMP @ 120 VAC ENERGIZE COIL TO OPEN CONTACT . . . COIL: 13 VDC 650 OHMS
SPECIAL PRICE $1.00 EACH

FREE! SEND FOR NEW LARGER! 48 PAGE CATALOG

MINIATURE TOGGLE SWITCHES
ALL ARE RATED 5 AMPS @ 125 VAC

S.P.D.T. (on-on)
P.C. STYLE. NON-THREADED BUSHING.
75¢ EACH
10 FOR $7.00

S.P.D.T. (on-on)
SOLDER LUG TERMINALS.
$1.00 EACH
10 FOR $9.00
100 FOR $80.00

S.P.D.T. (on-off-on)
SOLDER LUG TERMINALS.
$1.00 EACH
10 FOR $9.00
100 FOR $80.00

S.P.D.T. (on-off-on)
NON-THREADED BUSHING. P.C. STYLE
75¢ EACH
10 FOR $7.00

S.P.D.T. (on-on)
P.C. LUGS. THREADED BUSHING.
$1.00 EACH
10 FOR $9.00
100 FOR $80.00

D.P.D.T. (on-on)
SOLDER LUG TERMINALS.
$2.00 EACH
10 FOR $19.00
100 FOR $180.00

ALL ELECTRONICS CORP.
905 S. VERMONT • P.O. BOX 20406 • LOS ANGELES, CA 90006
• QUANTITIES LIMITED • MINIMUM ORDER $10.00 • USA: $2.50 SHIPPING NO C.O.D.'s
• FOREIGN ORDERS INCLUDE SUFFICIENT SHIPPING • CALIF. RES. ADD 6½%
↙20

MFJ 24 HOUR CLOCKS

Your choice: dual 24 hour LCD display, or 24/12 hour with ID timer, or 12 inch quartz analog.

$39.95 DUAL 24 HOUR LCD MFJ-104

Two independant 24 hour LCD displays! Read both GMT and local times at a glance.
Six digit main display has seconds readout. Four digit auxiliary. Switch reverses main/aux.
Alarm plays 4 selectable melodies. Alarm "ON" indicator. Snooze button.
Quartz timing. Synchronizable to WWV.
Flip-top cover serves as stand.
Night light. Forward/reverse, fast/slow set buttons. Lock function prevents mis-setting. Display main time only, main/auxiliary or main/alarm time. Includes battery. 4x2x1/2 inches.

$32.95 24/12 HOUR, ID TIMER MFJ-102

Switchable 24 hour GMT or 12 hour format.
ID timer sounds every 9 minutes after reset.
Switchable seconds readout.
Observed timer. Just start clock from zero and note time of event up to 24 hours.
Bright blue 0.6" vacuum fluorescent digits.
Alarm with snooze function. Synchronizable with WWV. Fast/slow set buttons. Lock function prevents mis-setting. Power out, alarm "ON" indicators. 110 VAC, 60 Hz (50 Hz with simple modification). UL approved.
Black, brushed aluminum top/front. 6x2x3".

$49.95 24 HOUR QUARTZ MFJ-105

True 24 hour quartz wall clock has huge 12 inch diameter face. Gives excellent visability across computer /radio room.
Fifteen seconds per month accuracy.
Single "AA" battery provides over one year operation, immunity from power line failure and eliminates power cord.
Sweep second hand. Brown hi-impact case. Glass front. 24 hour military time format.

Order from MFJ and try it. If not delighted, return within 30 days for refund (less shipping).
One year unconditional guarantee.
Order yours today. Call toll free 800-647-1800. Charge VISA, MC. Or mail check, money order. Add $4.00 each for shipping and handling.

CALL TOLL FREE 800-647-1800
Call 601-323-5869 in Miss., outside continental USA, tech/repair info. Telex 53-4590 MFJ STKV

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762 ↙233

DIRECTION FINDING?

- ★ Doppler Direction Finding
- ★ No Receiver Mods
- ★ Mobile or Fixed
- ★ Kits or Assembled Units
- ★ 135–165 MHz Standard Range

- ★ Circular LED Display
- ★ Optional Digital Display
- ★ Optional Serial Interface
- ★ 12 VDC Operation
- ★ 90 Day Warranty

New Technology (patent pending) converts any VHF FM receiver into an advanced Doppler Direction Finder. Simply plug into receiver's antenna and external speaker jacks. Use any four omnidirectional antennas. Low noise, high sensitivity for weak signal detection. Kits from $270. Assembled units and antennas also available. Call or write for full details and prices.

DOPPLER SYSTEMS, 5540 E. Charter Oak, Scottsdale, AZ 85254 (602) 998-1151
↙425

PACKET RADIO

ASCII—USA/AX.25 HDLC CONVERTER
USA/AX.25 is AMRAD/ARRL approved digital format STANDARD used on amateur packet radio networks

PAC/NET board only Assembled/Tested. No ICs. 90 day warranty	$80.00
Package of all ICs except 2-2716 EPROMs	$80.00

PAC/NET SYSTEM

PAC/NET SYSTEM $240.00
System Tested 4.5 × 6" board complete with all IC s and programmed EPROMs personalized for each purchaser. Requires only single 8-10 volt ½ amp power. 1 year guarantee of hardware/software/AX.25 standard RS232 serial ASCII at any user baud rate. RS232 HDLC for 202 modem used for AFSK or direct to RF equipment for FSK.

Custom Systems Custom Programming
BILL ASHBY AND SON
K2TKN—KA2OEG 201-658-3087
BOX 332 PLUCKEMIN N.J. 07978

↙See List of Advertisers on page 114

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 6

group that puts out *Computerworld, Infoworld,* and so on...a company several times the size of my firm in sales. The date was significant to me because it was eight years to the day from when I called the editor of a small micro newsletter to come up and discuss starting a magazine—and we agreed to give it a try. Five weeks later, the first issue of *Byte* went to the printer. Those were five frantic weeks, I'll tell you.

Getting *Byte* started was exhausting work but fun. We'd just gotten it off to a good start when the editor and my office manager moved the magazine out in the middle of the night, a stunt which I still haven't gotten over.

The merger means that we'll be able to do more promotion of our current magazines. It means we'll be able to start more magazines—and I have a bunch of them all planned out. Each magazine is going to require a staff, so we'll be needing 200 or 300 people to help out—editors, writers, technicians, programmers, people for advertising sales, typesetting, graphic arts, circulation, data processing, and so on.

Then there are a number of special projects such as my planned technical/business college. We're going to need management teams to get these projects going and run them. Most of this is going to be done in New Hampshire, but eventually we'll be growing into other areas of the country.

If you are interested in getting involved with some exciting new ideas, you should get a letter off to me telling me what you think you might be able to do. I'm looking right now for non-smokers with a history of enthusiasm and the ability to make things happen with a minimum of supervision.

There won't be any astronomical salaries when we are starting new projects, but we will plan to make it well worthwhile for those who are the most helpful in starting the new projects.

For instance, there are a number of products that I'd like to have made in Asia and imported for sale here. I've got the contacts in Asia to handle that end, but I need the people to handle the project from the New Hampshire end...setting up the advertising, importation, and distribution of the products. This should be able to grow into a substantial business by itself.

Why New Hampshire? Well, mostly because this is one of the best places in the country to live. The quality of life is wonderful and the cost of living is far less than New York or Silicon Valley. We still don't have any state sales or personal income taxes in New Hampshire. We're in a small town with all of the advantages of a small town. The people are friendly and the crime rate is so low that few people even bother to lock their homes.

If you are looking for the chance of a lifetime to get in on some new projects...and if you think you can hack it...let me know. You're going to have to prove you can get things done. We have no free rides here, just a bunch of enthusiastic people all having the time of their lives working hard and turning out first-rate products. We're working out of old houses, converted motels, barns, and so on. This is not IBM.

You can be old, young, black, white, red, brown, male, female, undecided, but if you smoke, please don't bother me, okay? The air up here is invisible and we want it to stay that way.

We need people who astound us by how much they get done, not people looking for a way to laze through life, producing more baloney than work. We've already tried a bunch of those people and sent them on to work for our competitors.

The merger means that we have a guarantee of the money we need to move ahead on as many projects as I can find teams to work on. And if we run out of projects to get started, I'll have more. I come up with an idea for a good solid project every few days.

When you think about it, by the time you put my six magazines together with those Pat is already publishing, we're a very strong combination. I think we'll be able to parlay this group into a pilot model of the college of the future or into perhaps an educational satellite television network.

Pat is much like me—full of ideas and enthusiasm. I think we're going to really make things hum in the communications field. Care to join us?

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

RADIOTELETYPE

Like most who became involved with radioteletype before the days of microcomputers, my entry into the world of the green keys was not an easy one. While I had no trouble conquering the technical side of the field, finding a functioning teleprinter at a reasonable cost was another story.

After several weeks of searching, it was best-friend Jonathan Bird WA2MJK (now KA@BYW) who located a Model 19 for me. The next Saturday, we headed over to the Garden State to pick up the unit.

I'll never forget the face of the fellow I bought the machine from as we told him we wanted to stuff the unit into my subcompact Mustang II. I'll also never forget almost losing Jonathan and my new machine halfway across the George Washington Bridge.

This month, FUN! looks at the world of RTTY. The column is dedicated to those who got their start in the days when you could tell a radioteletype operator by the musty, greasy smell of his shack.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) RTTY keyboard setting.
5) Full or _____ duplex
8) Amplification factor
9) Adjustable aperture in SSTV camera
11) _____ QSL
12) Audio compression is said to add this
15) Terminal unit (abbr.)
16) Computer section (abbr.)
17) Computer memories
20) Partner to 17 across
21) Austria prefix
22) Slang for CPU: electronic _____
24) Transmitter-generated signal for operator
26) To empty buffer
28) CP/M, 3.3, UNIX, for instance (abbr.)
29) Trademark for teleprinter

Down

1) Local circuit
2) _____ pot
3) Interference type (abbr.)
4) Sweden prefix
6) Popular amplifier brand
7) 3.6125 MHz, 880 kHz, 1 GHz
10) Slang for unwanted output
13) Opposite to 1 across
14) No-keyboard TTY (abbr.)
18) _____ 32
19) Look
23) Discharge between electrodes
24) 170 Hz _____
25) To subject a component to an action
27) Slang for current unit or power booster
28) German prefix

ELEMENT 2—MULTIPLE CHOICE

1) Which of the following amateurs never wrote a RTTY series for CQ magazine?
   1) Wayne Green W2NSD/1
   2) Byron Kretzman W2JTP
   3) John Edwards KI2U
   4) Al Gorithm W2RY

2) At which of the following frequencies can you send data at 1200 baud?
   1) 17000 kHz
   2) 3.625 MHz
   3) 14.090 MHz
   4) 28.300 MHz

3) What does the FCC call Baudot?
   1) Murray
   2) International Telegraph Alphabet Number 2
   3) Morse
   4) The FCC never refers to Baudot

812-422-0231

Mon-Fri 9AM-6PM
Sat 9AM-3PM

✓449

The HAM SHACK

808 N. Main
Evansville, IN 47711

Prices and Availability Subject to Change

AEA
CP-1 New Computer Interface $189.00
AMT-1 Amtor Terminal 475.00
144 Isopole Antenna 40.00
ALLIANCE
HD73 (10.7 sq ft) Rotator $99.00
U-110 Small Rotator 49.00
ASTRON
RS7A 5-7 Amp Power Supply $49.00
RS12A 9-12 Amp Power Supply 69.00
RS20A 16-20 Amp Power Supply 89.00
RS20M 16-20 Amp w/meter 109.00
RS35A 25-35 Amp 135.00
RS35M 25-35 Amp w/meter 149.00
RS50A 37-50 Amp 199.00
RS50M 37-50 Amp w/meter 225.00
VS-20M Variable w/meter 125.00
VS-35M Variable w/meter 175.00
VS-50M Variable w/meter 249.00
B&W
Folded Dipole 80-10 Meter, Only 90' Long, No Tuner Necessary $135.00
BASH
Books and Tapes $9.95
BENCHER
BY-1 Paddle/BY-2 Chrome $36.00/45.00
ZA-1A Balun 16.50
BUTTERNUT
HF6V 80-10 Meter Vertical $119.00
CUSHCRAFT
A3 Tribander 3EL $179.00
A4 Tribander 4EL 229.00
214FB Boomer 14EL FM 69.00
32-19 Super Boomer 19EL 2M 83.00
ARX-2B Ringo Ranger II 2M 39.00
416-TB 65.00
DAIWA
CN-520 1.8-60 MHz SWR/Pwr Mtr $63.00
CN-620B 1.8-150 MHz SWR/Pwr Mtr 110.00
DRAKE
TR7A Xcvr w/PS7 ..... $1,435.00
R7A Receiver 1,225.00
TR5 Xcvr w/PS75 ..... 675.00
ENCOMM (SANTEC)
ST-144/uP, 220/uP, 440/uP
The Handhelds Offering the Most Features
Call for Your Discount Price
HAL
DS3100/MPT/ST6000 ..... $2,825.00
CT2200/KB2200 ..... 945.00
CWR6850 Telereader 745.00
HY-GAIN
TH7 DXS 7EL Tribander $375.00
TH5 MK2S 5EL Tribander 319.00
Explorer 14 Tribander 279.00
V2S 2 Meter Vertical 39.00
Ham IV 15 sq ft Rotator 195.00
T2X 20 sq ft Rotator 249.00
Free Shipping on all crank-up towers
ICOM
We Have All the Great ICOM Transceivers In Stock
Call About the New Ones Now Available
IC-2AT ..... Now Only $215.00
3AT/4AT Handhelds 235.00
25A new display & mic 305.00
290H 2M All Mode 479.00
45A 440 MHz 349.00
R70 Superb Receiver 629.00
KLM
KT34A 4EL Triband Beam $299.00
KT34XA 6EL Triband Beam 459.00
144-148-13LBA 2M Long Boomer 79.00
143-150-14C 2M Satellite Ant 79.00
420-470-18C Satellite Ant 59.00
Maximizer Antennas ..... Call
KANTRONICS
The Fantastic Interface for CW, RTTY, ASCII
Software Available for VIC20, VIC64, APPLE, ATARI, TR80C, TI99
Call for a Package Price
LARSEN
NLA-150-MM 5/8 Wave 2M Mag Mt $39.00
MFJ
1224 New Computer Interface ..... Call
941C Tuner/Meter/Ant. Switch/Balun $81.00
422 Keyer/BENCHER Paddle combo 89.00
313 VHF Conv for HT 36.00
MIRAGE
B1016 10/160 Preamp $245.00
B3016 30/160 Preamp 199.00
ROHN
25G $42.00
SHURE
444D Desk Mic/414A Hand Mic $50.00/36.00
TEN-TEC
New 2M Handheld ..... Call
Argosy II Digital $535.00
2KW Tuner Kit 185.00
The Fantastic Corsair ..... Call
TOKYO HY-POWER
HL30V 2/30W Amp $63.00
HL160V 3 or 10/160W Preamp 295.00
HC2000 2KW Tuner 295.00
HL82V 10/80W Preamp 145.00
YAESU Now in Stock ..... Call for Prices

Send SASE for Our New & Used Equipment List
Prices are FOB Evansville

✓See List of Advertisers on page 114

WORLD TIME WATCHES

the newest and best watches for hams from ACI

5 modes plus hourly chime

dual time shows GMT & local time

12/24 hour time

5 year lithium battery

ACI's new HAM-II's functions include local time, a second time zone for GMT, count-up and count down stopwatches, alarm, hourly chime, and high brightness backlight. The special tri-function display shows a two-alpha day of the week, digital day-month, and six digit time in the main display. The second time zone display shows mode (T2), four digit local time and six digit GMT (or any other time zone). It's ideal for contests and logkeeping. The HAM-II, like its predecessor the HAM-I, it built rugged to last with a scratch resistant mineral glass crystal. The HAM-II case is polycarbonate, water resistant to 2.4 ATM, and the polyurethane band remains flexible even at very low temperatures.

4 modes plus hourly chime

Independent analog/digital

12/24 hour time

ACI's HAM-III breaks the ana-digi price barrier with a rugged and functional, yet handsome watch for hams. It combines independently functioning analog and digital timepieces, both with quartz crystal accuracy. While the analog section is on local time, the digital section can display your choice of month-date-day, six digit time (ideal for GMT) with a 12/24 hour option, alarm time, or six digit chronograph. The HAM-III is built rugged with a scratch resistant crystal, die cast case, stainless steel band, and German time movement. The HAM-III is water resistant to 2.4 atm. It's available with a white face and stainless band, or goldtone face and stainless/goldtone band.

SPECIAL OFFER

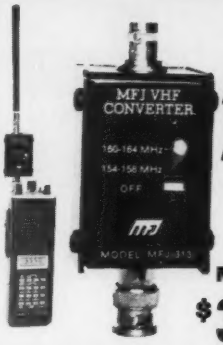
buy a HAM-II and a HAM-III and get a 10% discount off the HAM-III

HAM-II ..... $22.95 HAM-III $49.95
HAM-III/stainless-gold $59.95
add $3.00 per order for shipping and handling. CA. residents ad 6½% sales tax. VISA, M/C accepted.

To order, call or write:
Advanced Communications Int'l
2411 Lincoln Avenue
Belmont, CA. 94002
✓448 **(415) 595-3949**

Hear Police/Fire Weather

on 2 Meter Handhelds with this MFJ VHF Converter.



Scanning Handhelds become Police/Fire Scanners

MFJ-313
$39.95

New MFJ VHF converter turns your synthesized scanning 2 meter handheld into a hot Police/Fire/Weather band scanner.

144-148 MHz handhelds receive Police/Fire on 154-158 MHz with direct frequency readout. Hear NOAA weather, maritime coastal plus more on 160-164 MHz.

Mounts between handheld and rubber ducky.

Feedthru allows simultaneous scanning of both 2 meters and Police/Fire bands. No missed calls.

Highpass input filter and 2.5 GHz transistor gives excellent uniform sensitivity over both bands. Crystal controlled.

Bypass/OFF switch allows transmitting. Won't burn out if you transmit (up to 5 watts) with converter on. Low insertion SWR. Uses AAA battery. 2¼x1½x1½ in. BNC connectors.

Enjoy scanning, memory, digital readout, etc. as provided by your handheld on Police/Fire band.

220 MHz Converter for 2 M Handheld

MFJ-314
$59.95

MFJ-314, like MFJ-313 but lets you receive 221-225 MHz on your 2 meter handheld.

Police/Fire/Weather Band Converter for 2 Meter Mobile Rigs.

MFJ-312
$59.95

MFJ-312, like MFJ-313 but for mobile 2 meter rigs. Transmit up to 40 watts thru converter without damage. SO-239 connectors. Mobile mounting brackets. Rugged. "ON" LED. Use 12 VDC or AAA battery. 3x4x1 in.

Order from MFJ and try it-no obligation. If not delighted, return it within 30 days for refund (less shipping). One year unconditional guarantee.

Order today. Call toll free 800-647-1800. Charge VISA, MC or mail check, money order for amount indicated plus $4.00 each shipping.

Hear police/fire/weather. Order now. ✓234

CALL TOLL FREE ... 800-647-1800

Call 601-323-5869 in Miss.,outside continental USA, tech/order/repair info. Telex 53-4590.

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

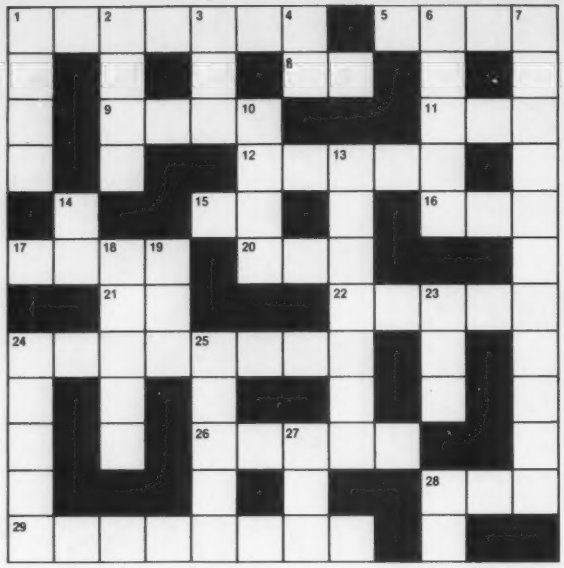


Illustration 1.

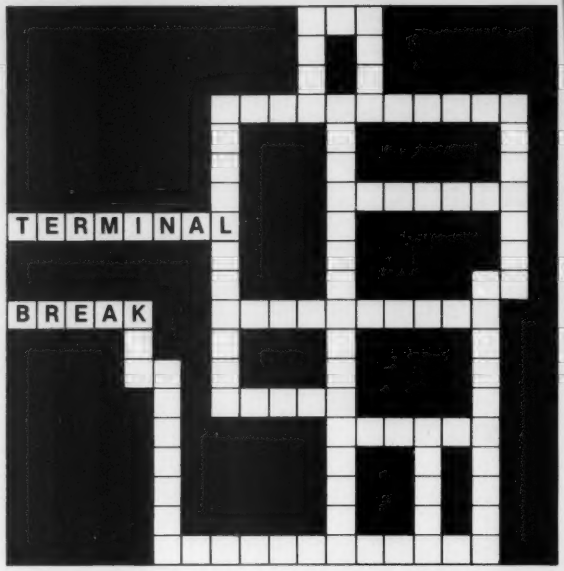


Illustration 2.

4) AMTOR is:
   1) A new, error-free digital transmission method forbidden on amateur frequencies.
   2) A new, error-free digital transmission method permitted on amateur frequencies.
   3) A type of nine-level code.
   4) A teleprinter brand.

5) Which of the following companies has never manufactured teleprinters?
   1) Olivetti
   2) Creed
   3) Seimans
   4) Remington

ELEMENT 3—TRUE-FALSE

	True	False
1) The two signals generated by RTTY are called "mark" and "trade."	_____	_____
2) The maximum RTTY signal shift permitted by the FCC is 850 Hz.	_____	_____
3) Baudot and Murray codes are one and the same.	_____	_____
4) ASCII is a seven-level code.	_____	_____
5) Baudot is a four-level code.	_____	_____
6) Novices can send RTTY within Novice bands.	_____	_____
7) General-, Advanced-, and Extra-class amateurs can send RTTY within Novice bands.	_____	_____
8) The Teletype® Company is owned by RCA.	_____	_____
9) Under traditional AFSK standards, the mark tone is the lower frequency signal.	_____	_____
10) One of the founders of the Teletype Company was Joy Morton, who also was founder of the Morton Salt Company.	_____	_____

ELEMENT 4—HAMAZE
(Illustration 2)

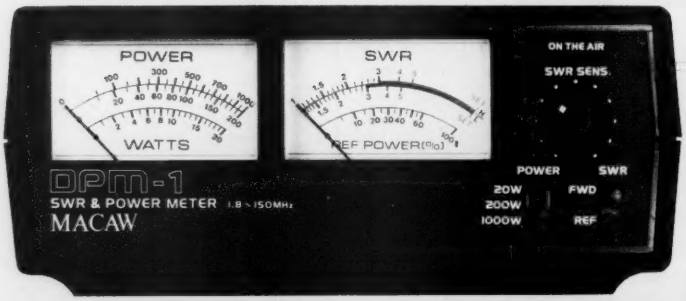
Here's a new type of maze specifically geared to hams. The object is to start at "Terminal" and trace your way to "Break" by filling in the answers to the clues given below. To help you on the way, we've already given you the first and last clue answers. All words read either vertically downward or from left to right. Each new word is on a perpendicular angle to the previous word. Words join on a common letter. Good luck!

1) Computer operating console
2) RTTY power circuit
3) Energy
4) Tuning _____
5) Display unit
6) What this month's column is about
7) RTTY test letters
8) Printing fabric
9) Natural noise
10) What the brown fox is
11) Automatic reply system
12) Skyhook
13) German prefix
14) To joke with someone
15) Make and _____

SWR and POWER METER

DPM-1

MACAW's DPM-1 SWR/Power Meter has a frequency range of 1.8 to 150 MHz and a power range of 0-20, 200 and 1000W in three ranges. The DPM-1 is compact, lightweight and measures SWR and power simultaneously, only $49.95. Freight Prepaid Anywhere In U.S. Order by telephone or mail:



VISA
MASTERCHARGE

MACAW ELECTRONICS INC.
5355 Avenida Encinas • Dept. B
Carlsbad, CA 92008 • (619) 438-2326

236

RF TRANSISTORS

FRESH STOCK - NOT SURPLUS

2-30 MHz

P/N	Net	Match/Pr	P/N	Net	Match/Pr
MRF412	$18.00	$39.00	MRF455	$13.50	$30.00
MRF421	27.00	58.00	MRF455A	13.50	30.00
MRF450	12.50	28.00	MRF458	18.00	40.00
MRF450A	12.50	28.00	MRF492	20.00	43.00
MRF453	15.00	33.00	SRF2072	15.00	33.00
MRF435A	15.00	33.00	SRF2769	15.00	33.00
MRF454	16.50	36.00	CD2545	18.50	40.00
MRF454A	16.50	36.00	CD3424	19.00	41.00

High Gain Matched Pairs & Quads Available

P/N	Net	P/N	Net
MRF406	$14.50	MRF475	$ 5.00
MRF422	39.50	MRF476	3.50
MRF433	14.50	MRF477	13.00
MRF435	42.00	SD1407	37.00
MRF449	14.50	SD1487	28.00
MRF449A	14.50	S10-12	14.50

VHF & UHF TRANSISTORS

Type	Mount	Rating	MHz	Net/ea.
MRF238	(s)	30W	145-175	$13.00
MRF240	(s)	40W	145-175	15.00
MRF245	(F)	80W	130-175	27.00
MRF247	(F)	80W	130-175	27.00
MRF492	(F)	70W	27-50	20.00
SD1416	(F)	80W	130-175	29.50
SD1477	(F)	125W	130-175	37.00
SD1441	(F)	150W	130-175	83.50
2N6081	(s)	15W	130-175	7.75
2N6082	(s)	25W	130-175	9.75
2N6083	(s)	30W	130-175	9.75
2N6084	(s)	40W	130-175	12.00
2SC1955	—	1W	130-175	15.00
2SC2289	—	5W	130-175	20.00
MRF641	(F)	15W	430-470	18.00
MRF644	(F)	25W	430-470	21.50
MRF646	(F)	45W	430-470	24.50
MRF648	(F)	60W	430-470	33.50

Technical Assistance and cross-reference information on CD, PT, RF, SRF & SD P/N's; Call our Engineering Dept. (619) 744-0728

WE SHIP SAME DAY — C.O.D. or VISA/M.C.
Minimum Order $20.00 — Add $3.50 Shipping
RF Parts Catalog Avail. — OEM & Quantity Discounts
ORDERS ONLY: 800-854-1927

WESTCOM
1320 Grand Ave. San Marcos
California 92069 (619) 744-0728

MFJ NOISE BRIDGE

Adjust antenna for maximum performance. Measure resonant frequency, radiation resistance, reactance. Individually calibrated resistance scale, expanded capacitance range, built-in range extender gives accurate extended measuring range.

- **Individually calibrated resistance range**
- **Built-in range extender**
- **Expanded capacitance range**

$59.95

NEW FEATURES: Individually hand calibrated resistance scale, expanded capacitance range (±150 pf), built-in range extender gives accurate measurements and much extended measuring range, 1-100 MHz, Simple to use. Comprehensive computer proven manual.

This New MFJ-202B Noise Bridge lets you quickly adjust your single or multiband dipole, inverted vee, beam, vertical, mobile whip or random system for maximum performance.

Tells resonant frequency and whether to shorten or lengthen your antenna for minimum SWR over any portion of a band.

Works with any receiver or transceiver. SO-239 connectors. 5x2x4 inches. Use 9 volt battery.

Other uses: tune transmatch: adjust tuned circuits; measure inductance, RF impedance of amplifiers, baluns, transformers; electrical length, velocity factor, impedance of coax; synthesize RF impedances with transmatch and dummy load.

Order from MFJ and try it-no obligation. If not delighted, return it within 30 days for a refund (less shipping). **This bridge is unconditionally guaranteed for one year.**

To order, simply call us TOLL FREE 800-647-1800 and charge it to your VISA or Master Charge account or mail us a check or money order for $59.95 plus $4.00 shipping and handling for MFJ-202B. **Order today.**

Put this MFJ Noise Bridge to work improving your antenna. Order from MFJ or see your dealer.

CALL TOLL FREE . . . 800-647-1800

Call 601-323-5869 in MS, outside continental USA or for tech./order/repair info. Telex 53-4590 STKV.

MFJ ENTERPRISES, INCORPORATED
Box 494, Mississippi State, MS 39762

✓260

VARIABLE MICROWAVE DOWN CONVERTER

QUANTITY DISCOUNT

1	79.95
10	74.95
25	69.95
50	64.95
100	59.95

All down converters built with New HOT Transistor for more amplifier gain. GREATER DISTANCE

NEW—Power supply built with push button simplicity ABC Switch built in

★ Coax cable not included

PLEASE ADD SUFFICIENT POSTAGE
1 Unit weighs 5 lbs.

To order by Visa or Master Charge
No C.O.D. orders
Call 800-428-3500
Information 317-291-7262
6254 La Pas Trail
Indianapolis, Indiana 46268

ELECTRONIC RAINBOW inc

✓71

✓See List of Advertisers on page 114

Illustration 1A.

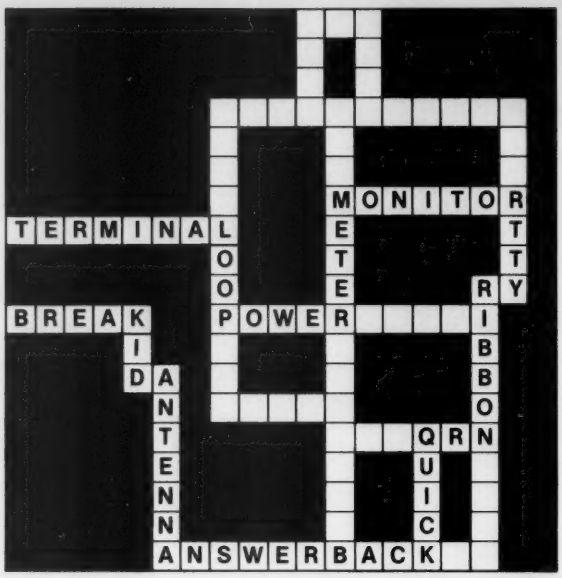


Illustration 2A.

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—4 And the checks are still in the mail.
2—4 Below 10 meters you're stuck with 300 baud.
3—2 You expected something simple from our government?
4—2 So long, CW jammers.
5—4 And you thought the world began and ended with Teletype.

Element 3:
1—False Mark and space. Trade and Mark are the Smith Brothers.
2—False Nine hundred is the magic number.
3—False A rose is a rose is a . . .
4—False Nope. Eight-level.
5—False Nope. Five-level.
6—False Not yet, anyway.
7—True Let's all confuse the Novices.
8—False AT&T.
9—True Mark: 2125 Hz, Space: 2975 Hz.
10—True Could I make something like that up?

Element 4:
See Illustration 2A.

SCORING

Element 1:
Twenty-five points for the completed puzzle, or one-half point for each question correctly answered.
Element 2:
Five points for each correct answer.
Element 3:
Four points for each correct answer.
Element 4:
Twenty-five points for the completed puzzle, or one point for each word solved.

Are you a friend of the green keys?
1-20 points—You run a CW net on 14.090 MHz.
21-40 points—Know a friend who used to own a Model 12.
41-60 points—Casual operator.
61-80 points—You keep an oil can on your night-table.
81-100+ points—You copy RTTY by ear.

HAM HELP

I am looking for a manual and schematics for an SG12 1800-4400-MHz signal generator. It was manufactured by Empire Devices, Inc.

Bill Stevenson WB3FZV
PO Box 518
Ridge MD 20680

Wanted: schematic for the KLM model 10-160BL 2-meter amplifier and schematics, cables, connectors, and control head for the Motorola U43GCT-1010B transmitter, type CC3006. I also need the solid-state power modules, both low and high voltage, for the T-195B transmitter.

And I would like to hear from anyone who has converted the R-392 receiver to solid state.

Tommy Norris KA4RKT
Rt. #1, Box 412
Auburn KY 42206

I need the first part of the assembly manual for the Heath GR-269 color TV. I bought this kit in Mexico, but all of the PC boards and their parts are missing. I have all of the other manuals except the one describing the PC boards. I also need information on the Venus SS-2 TV camera.

Hans U. Nadler XE1HUH
Gabino Barreda 54-B
Cto. Educadores
Cd. Satelite, Edo. de Mexico
Mexico

MULTI-BAND SLOPERS
160, 80, and 40 meters
Outstanding DX performance of slopers is well known. Now you can enjoy 2 or 3 band BIG-SIGNAL reports! Automatic bandswitching • Very low SWR • Coax feed • 2kw power • Compact • Ground or tower feed • Hang from any support 25 ft. high or higher • Easy to install • Very low profile • Complete instructions • Immediate shipment • Check ok

3 BAND SLOPER · 160, 80, & 40 Meters · 60 ft. long	$ 43.00 frt.ppd
2 BAND SLOPER · 80 & 40 Meters · 41 ft. long	$ 30.00 frt.ppd
3-BAND NO TRAP DIPOLE, 160, 80, & 40M · 113 ft. long	$ 66.00 frt.ppd
2-BAND NO TRAP DIPOLE, 80 & 40M · 84 ft. long	$ 49.00 frt.ppd

FOR ADDN'L INFO on these and other unique antennas: send SASE
W9INN ANTENNAS
BOX 393-S MT. PROSPECT, IL 60056

8th Annual Elmira Hamfest
Chemung County Fairgrounds
Horseheads, NY

Saturday, Sept. 24, 1983
Time: 6AM-5PM
Tickets: $2.00 advance
$3.00 at gate.

First Prize: ICOM 740 with power supply.
Second Prize: ICOM IC25H
Third Prize: ICOM IC25A

plus dozens of door prizes given out throughout the day

Free flea market, tech talk, dealer displays, breakfast and lunch available, and much more

Talk-in on:
147.96/.36
146.10/.70
146.52/.52

For more information and advance ticket purchase contact:
John Breese, 340 West Avenue, Horseheads, NY 14845

SYNTHESIZED SIGNAL GENERATOR

MADE IN USA

MODEL SG100D $349.95 plus shipping

• Covers 100 to 185 MHz in 1 kHz steps with thumbwheel dial • Accuracy 1 part per 10 million at all frequencies • Internal FM adjustable from 0 to 100 kHz at a 1 kHz rate • Spurs and noise at least 60 dB below carrier • RF output adjustable from 5-500 mV at 50 ohms • Operates on 12 Vdc @ 1/2 Amp • Available for immediate delivery • $349.95 plus shipping • Add-on Accessories available to extend freq. range, add infinite resolution, voice and sub-audible tones, AM, precision 120 dB calibrated attenuator • Call for details • Dealers wanted worldwide.

VANGUARD LABS ↙311
196-23 Jamaica Ave., Hollis, NY 11423
Phone: (212) 468-2720

Custom Mailing Lists on Labels!
Amateur Radio Operator NAMES
Custom lists compiled to your specifications
- Geographic by ZIP and/or State
- By License Issue or Expiration Date
- On Labels of Your Choice

Total List: 415,000 Price: $25/Thousand
Call **203: 438-3433** for more information
Buckmaster Publishing ↙255
70 Florida Hill Rd., Ridgefield, CT 06877

NEMAL ELECTRONICS
COAXIAL CABLE SALE

This Month's Specials — Same Day Shipping

POLYETHYLENE DIELECTRIC

RG213 noncontaminating 95% sheild mil spec.	36¢/ft.
RG174/U mil spec. 96% shield	10¢/ft.
RG11U 96% shield, 75-ohm mil spec	25¢/ft.
RG8U 96% shield, mil spec	$27.95/100 ft. or 31¢/ft.
RG6A/U double shield, 75-ohm	25¢/ft.
RG58AU stranded mil spec	12¢/ft.
RG58 mil spec. 96% shield	11¢/ft.

LOW LOSS FOAM DIELECTRIC

RG8X 95% shield	$14.95/100 ft. or 17¢/ft.
RG8U 80% shield	18¢/ft.
RG58U 80% shield	07¢/ft.
RG58U 95% shield	10¢/ft.
RG59U 100% foil shield, TV type	$7/100 ft. 10¢/ft.
RG8U 97% shield 11 ga. (equiv. Belden 8214)	31¢/ft.
Heavy Duty Rotor Cable 2-16 ga, 6-18 ga	36¢/ft.
Rotor Cable 8-con. 2-18 ga, 6-22 ga	19¢/ft.

RG8U-20 ft., PL-259 ea. end	$4.95
RG214U dbl silver shield, 50 ohm	$1.55/ft.
100 ft. RG8U with PL-259 on each end	**$19.95**
BELDEN Coax in 100 ft. rolls	
RG58U #9201	$11.95
Grounding strap, heavy duty tubular braid	
3/16 in. tinned copper	**10¢/ft.**
3/8 in. tinned copper	**30¢/ft.**

CONNECTORS MADE IN USA

Amphenol PI-259	79¢
PL-259 Teflon/Silver	$1.59
PL-259 push-on adapter shell	10/$3.89
PL-259 & SO-239	10/$5.89
Double Male Connector	$1.79
PL-258 Double Female Connector	98¢
1 ft. patch cord w/RCA type plugs each end	3/$1.00
Reducer UG-175 or 176	10/$1.99
UG-255 (PL-259 to BNC)	$3.50
Elbow (M359)	$1.79
F59A (TV type)	10/$2.15
UG 21D/U Amphenol Type N Male for RG8	$3.00
BNC UG88C/U, male	$1.25
3/16 inch Mike Plug for Collins etc	$1.25
UG273 BNC to PL-259	$3.00

FREE CATALOG
COD add $2.00—FLA. Res. add 5% Sales Tax

Orders under $30.00 add $2.00

Connectors—shipping 10% add'l, $3.00 minimum ↙412
Cable—shipping $3.00 1st 100 ft. $2.50 each add'l 100 ft.

1327 NE 119th Street, Dept. 73 , No. Miami, FL 33161 Call (305) 893-3924

2 GHz Dual Stage Microwave Preamplifiers

Use the **Ampire 2001** to improve the performance of your microwave receiving system. The broadband design lowers the system noise figure and increases the overall system gain. Use the **Ampire 2001** for the microwave TV band and the **Ampire 1690N** for the GOES and METEOSAT weather satellite band.

Ampire 1690N $139.95
Ampire 2001 ..... $129.95
Shipping: USA...$2.00 Foreign...$10.00

Data Service Company ↙346
3110 Evelyn Street
Roseville, MN • 55113
612-636-9469

MICROWAVE COMPONENTS

25 MW EXCITER	$49.95
45 MHZ SUBCARRIER	$19.95
AM VIDEO MODULATOR	$19.95
50 MW UP CONVERTER	$149.95

GIZMO ELECTRONICS, INC.

P.O. BOX 1205
PITTSBURG, KS 66762
PH. 316-231-8171

Kansas residents 3% sales tax ↙229

PRESERVE *73* WITH

BINDERS & FILE CASES.

Keep your issues of *73 Magazine* handy and protected in handsome and durable library file boxes or binders. Both styles are bound in red leatherette with the magazine logo stamped in gold.

File boxes: each file box holds 12 issues, with spines visible for easy reference.
$5.95 each, 3 for $17.00, 6 for $30.00
Binders: each binder holds 12 issues and opens flat for easy reading.
$7.50 each, 3 for $21.75, 6 for $42.00
(USA postage paid. Foreign orders must include $2.50 per item.)
Please state years desired (1977 to 1984).
Send check or money order to:
Jesse Jones Box Corp., P.O. Box 5120, Philadelphia, PA 19141; please allow 6 to 8 weeks for delivery. Sorry, no C.O.D. or phone orders.

Subscription Problem?

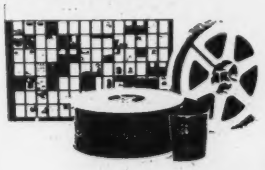
73 does not keep subscription records on the premises, therefore calling us only adds time and doesn't solve the problem.

Please send a description of the problem and your most recent address label to:

73 Amateur Radio's Technical Journal
Subscription Dept.
PO Box 931
Farmingdale, NY 11737

Thank you and enjoy your subscription.

this publication is available in microform



University Microfilms International

300 North Zeeb Road
Dept. P.R.
Ann Arbor, MI 48106
U.S.A.

18 Bedford Row
Dept. P.R.
London, WC1R 4EJ
England

↙See List of Advertisers on page 114

California Antenna Systems

Antenna Alternatives for the Radio Amateur

Introducing

HOT DIPPED GALVANIZED TOWERS

TRI-STACK Stacking Towers, 10' to 120' TS10 - 40' side supported package, all hardware complete - **$299.** *

TRI-TEL Telescoping Crank-up Towers
TT237 - 37' self support, 9 sq ft - **$499.** *
TT354 - 54' self support, 9 sq ft - **$799.** *

We have a full line of major brand antennas and accessories. Call for discount price quotes.

FREE 2 Meter JAYBEAM - Choice of LW5/2M 5 el. yagi or UGP/2M ground plane with Tower purchase, offer limited. Our way of saying "Thanks"!

*Terms: Certified Check or M.O. with order. Prices FOB Shingle Springs, CA 95682. Freight collect. Allow 2 to 6 weeks delivery. Calif. Residents add 6% Tax. Prices subject to change without notice.

6020 Windy Ridge Road
Shingle Springs, California 95682 ↩53
Telephone (916) 677-9540

QUALITY MICROWAVE TV SYSTEMS

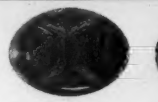
Complete Systems From $69.95

1.9 to 2.5 GHz Antennas

Galaxy Electronics
6007 N. 61st Ave.
Glendale, Az.
85301
1-602-247-1151
1-800-247-1151

COD's / Dealers Wanted

VISA MasterCard ↩178



CALL LETTERS OR 73 LOGO BELT BUCKLE

Navajo call-letter belt buckle. Hand crafted. Inlaid call-letters of blue torquoise, rust coral, white abalone, ironwood brown, or mother of pearl. The lightning bolts are yellow. Size: Med. 2.6" × 3.6" oval. Large: 3" × 4" oval. Style: Ladies or mens. The mens attaches to the left side, and the ladies to the right side of the belt.

Send: Call-name-and address.
Color of call-letters (or 73 logo).
Style: Ladies or mens.
$48.50 check or M/O for medium.
$61.50 check or M/O for large.

To: **LEE-ART, INC.**
112 n. Main Street
Shamrock, Texas 79079

We pay U.S. postage. (Foreign-add $2.50/item). Money-back guarantee. Allow 4-6 weeks delivery.

CABLE CONVERTER SALE

MAGNAVOX FV-25 - 26 CHANNEL WITH REMOTE CONTROL - VHF-MIDBAND-SUPERBAND - REG $59.95 - NOW **$49.95**

JERROLD JSX-3DIC - 36 CHANNEL WITH IN BAND GATED SYNC DECODER - REG $209.95 - NOW **$149.95**

JERROLD SB-3 - IN BAND GATED GATED SYNC DECODER - USE WITH ANY CONVERTER WITH OUTPUT ON CHANNEL 3 - REG $149.95 - NOW **$99.95**

UHF BLOCK CONVERTER - CONVERTS MIDBAND AND SUPERBAND TO UHF - REG $39.95 - NOW **$26.95**

SEND $1.00 (REFUNDABLE) FOR CATALOG

ADD $4.25 SHIPPING/HANDLING FOR EACH UNIT ORDERED

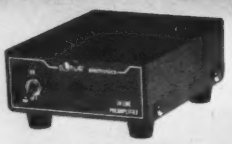
NYS ADD SALES TAX -C.O.D.'S OK

24 HOUR ORDER LINE
(607) 962-7313

ORDER DIRECT FROM -

TAYCO COMMUNICATIONS
R3-146A NARROWS CREEK ROAD
CORNING, NEW YORK 14830 ↩183

New Life for Tired Receivers



Lunar's line of RF actuated in-line receiving preamplifiers can spark up that otherwise dead band. Missing those weak ones? Become an elephant with new ears. Models available from 28-220 MHz bands. Simply insert between your transceiver and antenna, apply 12 VDC and enjoy. Standard SO-239 connectors on RF ports - BNC available. Typical performance at 144 MHz: 1.4 dB NF 10 dB gain. Low noise performance from Lunar - simply, the best.

LUNAR electronics
2775 Kurtz Street, Suite 11
San Diego, Ca 92110
(619) 299-9740 • Telex 181747 ↩220

CB TO TEN METER CONVERSION KITS

10 METER FM—Limiter discriminator board with specific instructions to fit over 80 different AM & SSB chassis

SSB-AM KITS—Now in stock kits for most CB models—23 or 40 channels

NEW & USED—FM—SSB—AM converted C.B.'s in stock

ANEXTER MARK ANTENNAS—You saw them at Dayton. Now in stock the HW-3 three band helewhip that covers 10—15—20 meters with no traps

FREE CATALOG—Write or call today

INDEPENDENT
CRYSTAL SUPPLY COMPANY
141 Rt. 6A, Box 183
Sandwich, Ma. 02563-0183
(617) 888-4302 ↩78

NOVICES... TECHNICIANS...

- Don't let Morse code requirement keep you from upgrading!
- General Class Code course takes you from 5 - 16 w.p.m.
- Simple, effective method helps you progress quickly.
- Deluxe album with two 1-hour cassettes and instruction booklet.

only **$19.00** (ck. or M.O.) postage paid

DATALOG P.O. Box 7010, Dept. 73-B Bismarck, ND 58502

Please send _____ @ $19.00 each (ND add 4%)
Name _____
Address _____
City _____ State _____ Zip _____

THE BEST PLACE To Look For New & Used Equipment Buy-Sell-Trade

Our 4th Year

NUTS & VOLTS MAGAZINE

NUTS & VOLTS
HAM GEAR
COMPUTERS
SOFTWARE
SCANNERS • OPTICS
TEST EQUIPMENT
MICROWAVE
SATELLITE
AUDIO VISUAL
NEW PRODUCTS
COMPONENTS • KITS
ANTIQUE ELECT.
PUBLICATIONS
PLANS • SERVICES

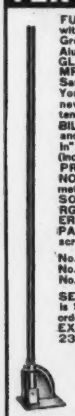
PO BOX 1111-G • PLACENTIA, CA 92670
(714) 632-7721 ↩137

JOIN THOUSANDS OF READERS NATIONWIDE, EVERY MONTH

U.S.A. SUBSCRIPTIONS
$ 7.00 - 1 YR. 3RD CLASS MAIL
$12.50 - 1 YR. 1ST CLASS MAIL
$25.00 - LIFETIME - 3RD CLASS

VISA **With Free Classified Ad** MasterCard

ALL BAND TRAP VERTICAL ANTENNAS!



FULL 1/4th WAVE - All Bands! Automatic Selection with proven Hi-Q Traps. 3 Models-ALL self supporting Ground or roof mount. HEAVY Double wall seamless Aluminum tower section - HI STRENGTH FIBERGLASS TUBING OVER -ALL. NO WOBBLY, LUMPY TRAPS - NO UNSIGHTLY CLAMPS needed Same size all the way up 1 1/4" - Traps hidden inside. You can use it in a 1 ft. sq. Backyard! Neighbors will never know this is a Hi-Power ALL Direction DX Antenna. FOR APARTMENTS, ROW HOUSES, MOBILE HOMES - CONDOS etc. where minimum space and neat appearence is MANDATORY! Instant "Drive In" ground mount (included). Use with or without radials (included) (All angle roof mount.-Extra) COMPLETELY PRETUNED - NO ADJUSTMENTS NEEDED EVER! NO TUNER NEEDED Over All Bands (except 80 meter - 400 KC) SWR 1-1 to 2-1 at Band edges, Stnd, SO239 connecter - 50 ohm for any length RG58U - RG8U feedline. Matches ALL MAKES TRANSCIEVERS. 2000 Watt PEP, input power. Shipped - PREPAID IN USA. Assembles in 10 min. using only screwdriver. WEATHERPROOF!

No.-AVT80-10 — 5 Band — 25'6" — $179.95
No.- AVT40-10 — 4 Band — 18'9" — $129.95
No.- AVT20-10 — 3 Band — 11'4" — $99.95.

SEND FULL PRICE FOR PP DEL IN USA (Canada is $10.00 extra for postage, clerical, Customs etc.) or order using VISA, MASTER CARD or AMERICAN EXPRESS. Give Number and Ex. date. Ph 1-308-236-5333 9AM-6PM weekdays. We ship in 2-3 days. Prices will increase, so order NOW AND SAVE. All Antennas Guaranteed for 1 year - 10 day money back trial, if returned in new condition. Free Inf.

WESTERN ELECTRONICS ↩80
Dept. A7- 9 Kearney Nebr. 68847

CONTACT-80...

RTTY your TRS-80 with CONTACT 80 MARK II for 1983!

TRS-80, MOD III/IV INTERFACE (included with system) gives keyboard STATION CONTROL and connects with the TTY TU of your choice.
(No other equipment needed for CW operation)

Cassette & Disk Features:
- BAUDOT, ASCII & MORSE...
- CW RX speed AUTOSYNC & unique FIST-FIXER...
- TRI-SPLIT screen (user sets HIS way)...
- "Unlimited" STORED MSG. sizes...
- Automatic DYNAMIC BUFFER ALLOCATION...
- Live HARDCOPY plus other Line-printing...
- AUTO-ID, TIME/DATED transmissions...
- On screen "OSCILLSCOPE", CLOCK, COUNTERS...
- Unique EDITOR, CLOCKED-KEYING, NAME-LINE...
- AUTO-DIDDLE, K/B ROLLOVER, REPEATING KEYS...
- Fast CASSETTE I/O and many other features...

Additional Disk Features:
- Two-way message SELCALL. A "PERSONAL MSO"...
- AUTO-MONitor frequency activity to disk...
- SAVE, LOAD, KILL & DIR plus other I/O...

INTRODUCTORY SPECIAL

DISK VERSION.....$199.00
CASSETTE VERSION.....$179.00
CASSETTE, later upgrade to DISK.....$20.00
Guaranteed-Include Amateur CALLSIGN-POST PAID

ROYAL
407 Conkle Road ↙150
Hampton, GA 30228 Telephone: (404) 946-9314

CIRCUIT BOARD SALE

RS-232C Serial Line Monitor
LED indicators show activity and polarity of the 7 most common signals. DB-25 male and female connectors mount directly on circuit board to form a compact 2" x 3" unit. Mounts in series with your RS-232C cable. Kit includes all parts, directions and tips for use. Commercial quality, double sided fiberglas board with plated through holes.
Assembled and tested (SLM-1) 29.95
Kit (SLM-1K) 21.95
Board only (SLM-1MB) 6.95

Power Supply Board
Provides +5, +12 and -12 volts at 1 amp for your ham radio project. Uses 78xx series positive voltage regulators. Needs 2 transformer windings, 18-24 volts (1 center tapped). 3.50" x 4.50"
Assembled and Tested (PS-1) 21.95
Kit Less Xfmrs (PS-1K) 16.95
Board only (PS-1MB) 4.95

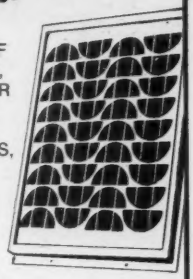
STD Bus Mother board
Single-sided fiberglas mother board. An excellent foundation for your STD bus computer. Mounts 12 of our 56 pin connectors. Provide your own card cage and save hundreds of dollars. 3.80" x 7.00"
Mother Board (MB-1) 15.95
Connectors (C56-125-ST) 3.80
MB-1 and 12 connectors (MB-SPC) 45.00

Please add $2.00 per order shipping and handling. CA residents include tax.

Esoteric Engineering Incorporated ↙29
PO Box 33602, San Diego, CA 92103
(619) 569-7860

PHOTOWATT
PHOTOVOLTAICS

Best Performance Best Price



SEND $2.00
FOR CATALOG OF PHOTOVOLTAICS, WIND AND WATER EQUIPMENT, INVERTERS, D.C. POWERED LIGHTS, STEREOS AND MUCH MORE.

ALTERNATIVE ENERGY ENGINEERING
P.O. BOX 339 DEPT. G,
REDWAY, CA 95560 (707) 923-2277 ↙43

RTTY
FOR THE
VIC 20
SIMPLE AND INEXPENSIVE
FULL-FEATURED RTTY

- BAUDOT And ASCII, All Common Speeds
- CW ID With Your Call Pre-Programmed
- Transmit/Receive (PTT) Control
- Use With Any Terminal Unit - Simple Hookup Instructions Supplied
- Highly Readable Screen Formatting

8K VERSION Also has 10 Message Buffers, Automatic CQ, Start and End Messages, Status Display, many other Features.

RTTY3K (req. 3K memory expansion) $19.95
RTTY8K (req. 8K memory expansion) $24.95
both versions supplied on cassette

Send Check or Money Order To:
MICROFISH SOFTWARE PRODUCTS
P.O. Box 920342 ↙257
Norcross, Georgia 30092

BUY! SELL! TRADE!
COMPUTER & HAM EQUIPMENT
COMPUTER TRADER
ANNUAL SUBSCRIPTION
$15.00
Low Ad Rates — Mailed Monthly
Foreign Subscriptions - $30.00 Year
FREE 50 Word Classified Ad with Subscription Order
COMPUTER TRADER®
Chet Lambert, W4WDR
1704 Sam Drive • Birmingham, AL 35235
(205) 854-0271
Sample Copy — $1.00

M/C
Visa
$129.95

NEW! HF WATTMETER

- Digital Resolution (0.1 or 1 Watt)
- Wideband (160 through 10 meters)
- Wide range (QRP to 1999 Watts)
- Detachable (RF Sampler un-plugs)
- Battery Saver turns off minutes after RF disappears
- Price includes—Readout, HF Sampler, battery, VSWR nomogram and complete schematics.
- 90 day warranty

↙219

write or call:
e-tek P.O. Box 625, Marietta, OH 45750
1-(614)-374-2280

YOU EARNED YOUR CALL!
NOW DISPLAY IT PROUDLY
IN A TOP QUALITY
LACOSTE-TYPE KNIT SHIRT.
ONLY $14.00 With your call in rich embroidery.
$1.50 extra for first name. Choose from 10 great colors: rust, cream, brown, green, yellow, navy, lt. blue, aqua, white, and black.

Adult sizes only S-M-L-XL Club and dealer inquiries invited. Please add $2.00 for P/H. Make check or money order payable to:
Coin Int'l Inc.
2305 N.W. 107 Ave.
Miami, Fl. 33172 ↙13
Allow 4 weeks for delivery Fl. residents add sales tax

VIC-20 BUFFS CHECK THIS!

40 column cart with 16K $149
4 cart expansion board $39
VIC-1541 Disk Drive $319
VIC-20 . . . . . $89

Write for our 20 page catalog of VIC hardware and software.

BEE COMPUTERS
P.O. Box 1627
Beeville, TX 78102
512-358-0698 ↙26
C.O.D.

2-12 MHZ USB TRANSCEIVER

RT-671/PRC-47 TRANSCEIVER —

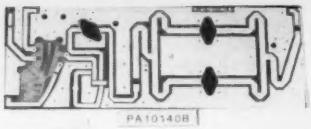
2-12 Mhz USB (voice/CW +800 Hz) in 100 Khz steps; 20 or 100 watts PEP. Partially transistorized Collins-designed set uses PL-177WA tube in P-A. Requires either 24 VDC 20 amps or 115 VAC 400 Hz power. 7x21¼x13½", 45 lbs. sh. Used-reparable . . . **$375.** With H-33 handset and AS-1320 long-wire antenna **$395.** Manual, partial reproduction . . . **$17** w/set purchase.

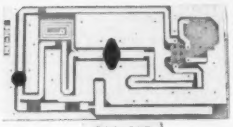
PRC-47 ACCESSORY PACK, transit case with 15' whip, speaker, headset, key, backpack harness, etc; 95 lbs. sh. wt. . . . . **$55** with RT-671 purchase.

R-389/URR VLF RECEIVER — Collins-built set covers 15-1500 Khz AM-CW in two ranges, 7-bands; 4-place mechanical digital tuning. Requires 115/230 VAC 60 Hz. Sold less Line Level and Carrier Level meters. 10½x19x17¼", 90 lbs. sh. Used-reparable . . **$250.** Power connector . . **$3.** Manual, partial repro . . **$17.**
Prices F.O.B. Lima, O. • VISA, MASTERCARD Accepted.
Allow for Shipping • Send for New FREE CATALOG '83
Address Dept. 73 • Phone: 419/227-6573

FAIR RADIO SALES ↙22
1016 E. EUREKA - Box 1105 - LIMA, OHIO - 45802

↙See List of Advertisers on page 114





EIMAC 4CX10,000D/8171 with SK300 and SK1306 $1200.00

SK300 and SK1306 Only. $ 350.00

(These are all new not used.) Limited Supply.

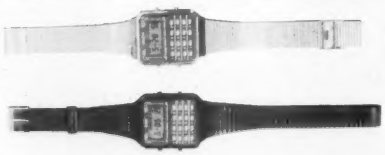
KLM ELECTRONICS, INC. VHF AMPLIFIER PC BOARDS AND RF TRANSISTOR KITS.

Model PA2-70B RF power input 2watts at 144 to 148MHz output 70watts 13.5vdc at 10amps.
$49.99 with data PC Board Only $14.99

MODEL PA10140B RF power input 10watts at 144 to 148MHz output 140watts 13.5vdc at 18amps.
$89.99 with data PC Board Only $19.99

GENEVA CALCULATOR WATCH

This attractive watch has the following modes:
Normal Time Setting,
Calendar Setting,
Daily Alarm Time Setting,
Weekly Alarm Time Setting,
Chronograph,
Calculator.



Featured in Black Plastic $24.99 or Featured in Stainless Steel $29.99

SILICON DIODES

MR751	100vdc	6Amps	10/$5.00	100/$38.00
MR510	1000vdc	3Amps	10/$3.75	100/$24.00
HEP170	1000vdc	2Amps	20/$2.00	100/$15.00
1N3209	100vdc	15Amps	$2.00	10/ $15.00
BYX21/200	200vdc	25Amps	$2.00	10/ $15.00
1N2138A	600vdc	60Amps	$5.00	10/ $40.00
DS85-04C	400vdc	80Amps	$10.00	10/ $80.00
1N3269	600vdc	160Amps	$15.00	10/$120.00
275Z41	300vdc	250Amps	$20.00	10/$175.00
7-5754	300vdc	400Amps	$30.00	10/$250.00
RCD-15	15KVDC	20ma.	$3.00	10/ $20.00
SMFR20K	20KVDC	20ma.	$4.00	10/ $30.00
1N4148	signal		30/$1.00	100/ $3.00

FAIRCHILD 4116 16K DYNAMIC RAMS 200ns. Part # 16K75

25 For $25.00 or 100 For $90.00 or 1000 For $750.00

FEED THRU SOLDER RF CAPACTORS

470pf +-20%

5/$1.00 or 100/$15.00 or
1000/$100.00

1000pf/.001uf +-10%

4/$1.00 or 100/$20.00 or
1000/$150.00

E PROMS

2708 1024x1	$2.00 each
2716 2048x8	$4.00 each
27L32/25L32	$10.00 each

HEWLETT PACKARD MICROWAVE DIODES

1N5711	(5082-2800)	Schottky Barrier Diodes	$1.00 or 10 for $ 8.50
1N5712	(5082-2810)	" " "	$1.50 or 10 for $10.00.
1N6263	(HSCH-1001)	" " "	$ .75 or 10 for $ 5.00
5082-2835		" " "	$1.50 or 10 for $10.00
5082-2805	Quad Matched	" " "	per set $5.00 or 10 for $40.00

Toll Free Number
800-528-0180
(For orders only)

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MHz electronics

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

"MIXERS"

WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above 8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min F=2GHz	dB 2.4 Typ.	MAG F=2GHz	dB 12 Typ.	$5.30
F=3GHz	dB 3.4 Typ.	F=3GHz	dB 9 Typ.	
F=4GHz	dB 4.3 Typ.	F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacturers, and described in the RF Data Book.

5pf	10pf	18pf	30pf	43pf	100pf	200pf	1 to 10pcs. $1.00 ea
5.1pf	12pf	22pf	32pf	51pf	110pf	220pf	11 to 50pcs. $ .90 ea
6.8pf	13pf	25pf	33pf	60pf	120pf	470pf	51 up pcs. $ .80 ea
7pf	14pf	27pf	34pf	80pf	130pf	500pf	
8.2pf	15pf	27.5pf	40pf	82pf	140pf	1000pf	

NIPPON ELECTRIC COMPANY TUNNEL DIODES $7.50

		MODEL 1S2199	1S2200
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ratio (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

Listsall Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

PRICE $7.50

Toll Free Number
800-528-0180
(For orders only)

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

MHz electronics

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

RF TRANSISTORS, MICROWAVE DIODES

PART	PRICE
1S2199	$ 7.50
1S2200	7.50
2N1561	25.00
2N1562	25.00
2N2857	1.55
2N2857JAN	2.55
2N2876	11.00
2N2947	18.35
2N2948	15.50
2N2949	3.90
2N2950	4.60
2N3375	8.00
2N3553	1.57
2N3632	13.80
2N3818	5.00
2N3866	1.30
2N3924	3.35
2N3927	17.75
2N3950	25.00
2N4072	1.80
2N4127	21.00
2N4427	1.30
2N4428	1.85
2N4957	3.45
2N4958	2.90
2N4959	2.30
2N5090	13.90
2N5108	4.00
2N5109	1.70
2N5160	3.45
2N5177	21.62
2N5179	1.00
2N5583	4.00
2N5589	8.65
2N5590	10.35
2N5591	13.80
2N5635	10.95
2N5637	15.50
2N5641	9.20
2N5642	10.95
2N5643	15.50
2N5645	13.80
2N5646	20.70
2N5691	18.00
2N5764	27.00
2N5836	5.45
2N5842	8.00
2N5849	20.00
2N5913	3.25
2N5922	10.00
2N5923	25.00
2N5941	23.00
2N5942	40.00
2N5944	9.20
2N5945	11.50
2N5946	19.00
2N6080	9.20
2N6081	10.35
2N6082	11.50

PART	PRICE
2N6083	$ 13.25
2N6084	15.00
2N6094 /M9622	11.00
2N6095 /M9623	12.00
2N6096 /M9624	15.50
2N6097	17.25
2N6136	21.85
2N6166	40.25
2N6201	50.00
2N6459	18.00
2N6603	12.00
2N6680	80.00
2SC756A	7.50
2SC781	2.80
2SC1018	1.00
2SC1042	12.00
2SC1070	2.50
2SC1239	2.50
2SC1251	12.00
2SC1306	2.90
2SC1307	5.50
2SC1760	1.50
2SC1970	2.50
2SC2166	5.50
8B1087 (M.A.)	25.00
A50-12	20.00
A283B	5.00
ALD4200N (AVANTEK)	395.00
AM123	97.35
AM688	100.00
BB105B	.52
BD4/4JFBD4 (G.E.)	10.00
BFQ85	1.50
BFR90	1.30
BFR91	1.65
BFW92	1.50
BFX89	1.00
BFY90	1.00
BGY54	25.00
BGY55	25.00
BGY74	25.00
BGY75	25.00
BL161	10.00
BLX67	11.00
BLY568CF	25.00
BLY87	13.00
BLY88	14.00
BLY89	15.00
BLY90	20.00
BLY351	10.00
C4005	20.00
CA402 (TRW)	25.00
CA405 (TRW)	25.00
CA612B (TRW)	25.00
CA2100 (TRW)	25.00
CA2113 (TRW)	25.00
CA2200 (TRW)	25.00
CA2213 (TRW)	25.00
CA2418 (TRW)	25.00

PART	PRICE
CA2612 (TRW)	$ 25.00
CA2674 (TRW)	25.00
CA2881-1(TRW)	25.00
CA4101 (TRW)	25.00
CA4201 (TRW)	25.00
CA4600 (TRW)	25.00
CD1889	20.00
CD2545	20.00
CMD514AB	20.00
D4959	10.00
D4987M	20.00
D5147D	10.00
D5506	10.00
D5827AM	20.00
DMD6022	30.00
DMS-2A-250	40.00
HEP76	4.95
HEPS3002	11.30
HEPS3003	30.00
HEPS3005	10.00
HEPS3006	19.90
HEPS3007	25.00
HEPS3010	11.34
HTEF2204 H.P.	112.00
5082-0112 H.P.	14.20
5082-0253 H.P.	105.00
5082-0320 H.P.	58.00
5082-0386 H.P.	POR
5082-0401 H.P.	POR
5082-0438 H.P.	POR
5082-1028 H.P.	POR
5082-2711 H.P.	23.15
5082-3080 H.P.	2.00
5082-3188 H.P.	1.00
5082-6459 H.P.	POR
5082-8323 H.P.	POR
35826E H.P.	POR
35831E H.P.	29.99
35853E H.P.	71.50
35854E H.P.	75.00
HPA0241 H.P.	75.60
HXTR3101 H.P.	7.00
HXTR3102 H.P.	8.75
HXTR6101/2N6617 H.P.	55.00
HXTR6104 H.P.	68.00
HXTR6105 H.P.	31.00
HXTR6106 H.P.	33.00
QSCH1995 H.P.	POR
JO2000 TRW	10.00
JO2001 TRW	25.00
JO4045 TRW	25.00
K3A	10.00
MA450A	10.00
MA41487	POR
MA41765	POR
MA43589	POR
MA43636	POR
MA47044	POR
MA47651	25.50

Toll Free Number
800-528-0180
(For orders only)

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MHz electronics

GaAs, TUNNEL DIODES, ETC.

PART	PRICE
MA47100	$ 3.05
MA47202	30.80
MA47771	POR
MA47852	POR
MA49558	POR
MB4021	POR
MBD101	1.00
MDO513	POR
MHW1171	42.50
MHW1182	48.60
MHW4171	49.35
MHW4172	51.90
MHW4342	68.75
MLP102	25.00
MM1500	32.32
MM1550	POR
MM1552	50.00
MM1553	50.00
MM1614	10.00
MM2608	5.00
MM3375A	11.50
MM4429	10.00
MM8000	1.15
MM8006	2.30
MO277L	POR
MO283L	POR
MO3757	POR
MP102	POR
MPN3202	10.00
MPN3401	.52
MPN3412	1.00
MPSU31	1.01
MRA2023-1.5 TRW	42.50
MRF212/208	16.10
MRF223	13.25
MRF224	15.50
MRF237	3.15
MRF238	12.65
MRF243	25.00
MRF245	34.50
MRF247	34.50
MRF304	43.45
MRF315	23.00
MRF420	20.00
MRF421	36.80
MRF422	41.40
MRF427	16.10
MRF428	46.00
MRF450/A	13.80
MRF453/A	17.25
MRF454/A	19.90
MRF455/A	16.00
MRF458	19.90
MRF463	25.00
MRF472	1.00
MRF475	2.90
MRF477	11.50
MRF502	1.04

PART	PRICE
MRF503	$ 6.00
MRF504	7.00
MRF509	5.00
MRF511	8.65
MRF605	20.00
MRF629	3.47
MRF644	23.00
MRF816	15.00
MRF823	20.00
MRF901	3.00
MRF8004	2.10
MS261F	POR
MT4150 Fair.	POR
MT5126 Fair.	POR
MT5481 Fair.	POR
MT5482 Fair.	POR
MT5483 Fair.	POR
MT5596 Fair.	POR
MT5764 Fair.	POR
MT8762 Fair.	POR
MV109	.77
MV1401	8.75
MV1624	1.42
MV1805	15.00
MV1808	10.00
MV1817B	10.00
MV1863B	10.00
MV1864A	10.00
MV1864B	10.00
MV1864D	10.00
MV1868D	10.00
MV2101	.90
MV2111	.90
MV2115	1.55
MV2201	.53
MV2203	.53
MV2209	2.00
MV2215	2.00
MWA110	7.45
MWA120	7.80
MWA130	8.25
MWA210	7.80
MWA220	8.25
MWA230	8.65
MWA310	8.25
MWA320	8.65
MWA330	9.50
NEC57835	5.30
ON382	5.00
PPT515-20-3	POR
PRT8637	POR
PSCQ2-160	POR
PT3190	POR
PT3194	POR
PT3195	POR
PT3537	POR
PT4166E	POR
PT4176D	POR

PART	PRICE
PT4186B	$ POR
PT4209	POR
PT4209C	POR
PT4566	POR
PT4570	POR
PT4571	POR
PT4571A	POR
PT4577	POR
PT4590	POR
PT4612	POR
PT4628	POR
PT4640	POR
PT4642	POR
PT5632	POR
PT5749	POR
PT6612	POR
PT6626	POR
PT6709	POR
PT6720	POR
PT8510	POR
PT8524	POR
PT8609	POR
PT8633	POR
PT8639	POR
PT8659	POR
PT8679	POR
PT8708	POR
PT8709	POR
PT8727	POR
PT8731	POR
PT8742	POR
PT8787	POR
PT9790	41.70
PT31962	POR
PT31963	POR
PT31983	POR
PTX6680	POR
RAY-3	24.99
40081	POR
40281	POR
40282	POR
40290	POR
RF110	25.00
SCA3522	POR
SCA3523	POR
SD1065	POR
SS43	POR
TP1014	POR
TP1028	POR
TRW-3	POR
UTO504 Avantek	70.00
UTO511 Avantek	75.00
V15	4.00
V33B	4.00
V100B	4.00
VAB801EC	25.00
VAB804EC	25.00
VAS21AN20	25.00

Toll Free Number
800-528-0180
(For orders only)

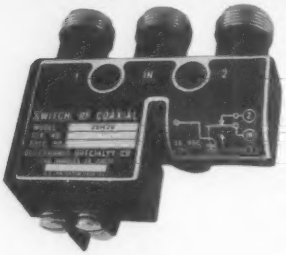
"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

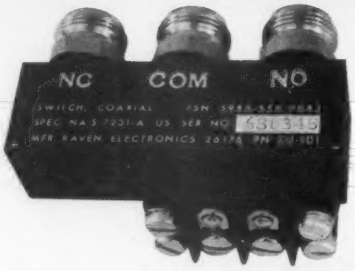
MHz electronics

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

COAXIAL RELAY SWITCHES SPDT

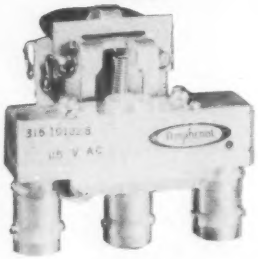
Electronic Specialty Co./Raven Electronics FSN 5985-556-9683 $49.00
Part # 25N28 Part # SU-01
26Vdc Type N Connector, DC to 1 GHz.





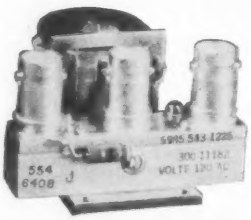
Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

$29.99



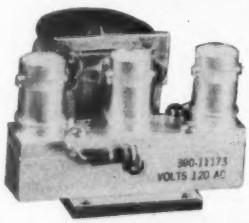
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

$39.99



FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99



BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00

$8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

MHz electronics

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

Toll Free Number
800-528-0180
(For orders only)

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

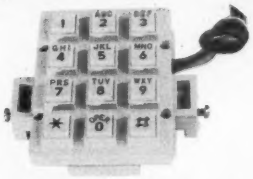
The Recall Phone Telephone employs the latest state of art communications technology.It is a combination telephone and automatic dialer that uses premium-quality,solid-state circuitry to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive.Alpha Cyanoacrylate.Set-Time 20 to 40 sec.,0.7fl.oz.(20gm.)
$2.00

TOUCH TONE PAD

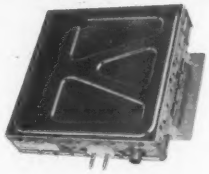
This pad contains all the electronics to produce standard touch-tone tones. New with data.



$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.



$19.99 or 10/$149.99

INTEGRATED CIRCUIT.		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTEGRATED CIRCUIT.

Features:

1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99

MOTOROLA MRF559 RF TRANSISTOR

hfe 30min 90typ 200max.
ft 3000mhz
gain 8db min 9.5typ at 870mhz
13db typ at 512mhz
output power .5watts at 12.5vdc at 870mhz.

$2.05 or 10/$15.00

MHz electronics

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

Toll Free Number
800-528-0180
(For orders only)
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$POR
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 8CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

TUBE CAPS (Plate)

HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

Toll Free Number
800-528-0180
(For orders only)

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

MHz electronics

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2C39/7289	$ 34.00	1182/4600A	$500.00	ML7815AL	$ 60.00
2E26	7.95	4600A	500.00	7843	107.00
2K28	200.00	4624	310.00	7854	130.00
3-500Z	102.00	4657	84.00	ML7855KAL	125.00
3-1000Z/8164	400.00	4662	100.00	7984	14.95
3B28/866A	9.50	4665	500.00	8072	84.00
3CX400U7/8961	255.00	4687	P.O.R.	8106	5.00
3CX1000A7/8283	526.00	5675	42.00	8117A	225.00
3CX3000F1/8239	567.00	5721	250.00	8121	110.00
3CW30000H7	1700.00	5768	125.00	8122	110.00
3X2500A3	473.00	5819	119.00	8134	470.00
3X3000F1	567.00	5836	232.50	8156	12.00
4-65A/8165	69.00	5837	232.50	8233	60.00
4-125A/4D21	79.00	5861	140.00	8236	35.00
4-250A/5D22	98.00	5867A	185.00	8295/PL172	500.00
4-400A/8438	98.00	5868/AX9902	270.00	8458	35.00
4-400B/7527	110.00	5876/A	42.00	8462	130.00
4-400C/6775	110.00	5881/6L6	8.00	8505A	95.00
4-1000A/8166	444.00	5893	60.00	8533W	136.00
4CX250B/7203	54.00	5894/A	54.00	8560/A	75.00
4CX250FG/8621	75.00	5894B/8737	54.00	8560AS	100.00
4CX250K/8245	125.00	5946	395.00	8608	38.00
4CX250R/7580W	90.00	6083/AZ9909	95.00	8624	100.00
4CX300A/8167	170.00	6146/6146A	8.50	8637	70.00
4CX350A/8321	110.00	6146B/8298	10.50	8643	83.00
4CX350F/8322	115.00	6146W/7212	17.95	8647	168.00
4CX350FJ/8904	140.00	6156	110.00	8683	95.00
4CX600J/8809	835.00	6159	13.85	8877	465.00
4CX1000A/8168	242.50*	6159B	23.50	8908	13.00
4CX1000A/8168	485.00	6161	325.00	8950	13.00
4CX1500B/8660	555.00	6280	42.50	8930	137.00
4CX5000A/8170	1100.00	6291	180.00	6L6 Metal	25.00
4CX10000D/8171	1255.00	6293	24.00	6L6GC	5.03
4CX15000A/8281	1500.00	6326	P.O.R.	6CA7/EL34	5.38
4CW800F	710.00	6360/A	5.75	6CL6	3.50
4D32	240.00	6399	540.00	6DJ8	2.50
4E27A/5-125B	240.00	6550A	10.00	6DQ5	6.58
4PR60A	200.00	6883B/8032A/8552	10.00	6GF5	5.85
4PR60B	345.00	6897	160.00	6GJ5A	6.20
4PR65A/8187	175.00	6907	79.00	6GK6	6.00
4PR1000A/8189	590.00	6922/6DJ8	5.00	6HB5	6.00
4X150A/7034	60.00	6939	22.00	6HF5	8.73
4X150D/7609	95.00	7094	250.00	6JG6A	6.28
4X250B	45.00	7117	38.50	6JM6	6.00
4X250F	45.00	7203	P.O.R.	6JN6	6.00
4X500A	412.00	7211	100.00	6JS6C	7.25
5CX1500A	660.00	7213	300.00*	6KN6	5.05
KT88	27.50	7214	300.00*	6KD6	8.25
416B	45.00	7271	135.00	6LF6	7.00
416C	62.50	7289/2C39	34.00	6LQ6 G.E.·	7.00
572B/T160L	49.95	7325	P.O.R.	6LQ6/6MJ6 Sylvania	9.00
592/3-200A3	211.00	7360	13.50	6ME6	8.90
807	8.50	7377	85.00	12AT7	3.50
811A	15.00	7408	2.50	12AX7	3.00
812A	29.00	7609	95.00	12BY7	5.00
813	50.00	7735	36.00	12JB6A	6.50

NOTE * = USED TUBE

NOTE P.O.R. = PRICE ON REQUEST

"ALL PARTS MAY BE NEW, USED, OR SURPLUS. PARTS MAY BE SUBSTITUTED WITH COMPARABLE PARTS IF WE ARE OUT OF STOCK OF AN ITEM.

NOTICE: ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Toll Free Number
800-528-0180
(For orders only)

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

MHz electronics

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

"FILTERS"

COLLINS Mechanical Filter #526-9724-010 MODEL F455Z32F

455KHZ at 3.2KHz wide. May be other models but equivalent. May be used or new. $15.99

ATLAS Crystal Filters

5.595-2.7/8/LSB, 5.595-2.7/LSB
8 pole 2.7KHz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-2.7/8/U, 5.595-2.7/USB
8 pole 2.7Khz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-.500/4, 5.595-.500/4/CW
4 pole 500 cycles wide CW. Impedance 800ohms 15pf In/800ohms 0pf out. 19.99

9.0USB/CW
6 pole 2.7KHz wide at 6dB. Impedance 680ohms 7pf In/300ohms 8pf out. CW-1599Hz 19.99

KOKUSAI ELECTRIC CO, Mechanical Filter #MF-455-ZL/ZU-21H

455KHz at Center Frequency of 453.5KC. Carrier Frequency of 455KHz 2.36KC Bandwidth.
Upper sideband. (ZU) 19.99
Lower sideband. (ZL) 19.99

****

CRYSTAL FILTERS

NIKKO	FX-07800C	7.8MHz	$10.00
TEW	FEC-103-2	10.6935MHz	10.00
SDK	SCH-113A	11.2735MHz	10.00
TAMA	TF-31H250	CF 3179.3KHz	19.99
TYCO/CD	001019880	10.7MHz 2pole 15KHz bandwidth	5.00
MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
PTI	1479	10.7MHz 8pole bandwidth 7.5KHz at 3dB, 5KHz at 6dB	20.00
COMTECH	A10300	45MHz 2pole 15KHz bandwidth	6.00
FRC	ERXF-15700	20.6MHz 36KHz wide	10.00
FILTECH	2131	CF 7.825MHz	10.00

****

CERAMIC FILTERS

AXEL	4F449	12.6KC Bandpass Filter 3dB bandwidth 1.6KHz from 11.8-13.4KHz	10.00
CLEVITE	TO-01A	455KHz+-2KHz bandwidth 4-7% at 3dB	5.00
	TCF4-12D36A	455KHz+-1KHz bandwidth 6dB min 12KHz, 60dB max 36KHz	10.00
MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
	CFM455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 50dB	6.65
	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
	CFU455C	455KHz +-2KHz bandwidth +-12.5KHz at 6dB , +-24KHz at 40dB	2.90
	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10,7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
TOKIN	CF455A/BFU455K	455KHz +-2KHz	5.00
MATSUSHIRA	EFC-L455K	455KHz	7.00

****

SPECTRA PHYSICS INC. Model 088 HeNe LASER TUBES

POWER OUTPUT 1.6MW. BEAM DIA. .75MM BEAM DIR. 2.7MR 8KV STARTING VOLTAGE DC
68K OHM 1WATT BALLAST 1000VDC +-100VDC At 3.7MA $59.99

ROTRON MUFFIN FANS Model MARK4/MU2A1

115 VAC 14WATTS 50/60CPS IMPEDENCE PROTECTED-F 88CFM at 50CPS
105CFM at 60CPS THESE ARE NEW $ 7.99

MHz electronics

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Toll Free Number
800-528-0180
(For orders only)

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

HEWLETT PACKARD SIGNAL GENERATORS

606A	50KHz to 65MHz in 6 bands +-1%,Output level adjustable 0.1uV to 3V into 50 ohms.Built-in crystal calibrator.400 -1000Hz modulation.	$ 650.00
606B	Same as above but has frequency control feature to allow operation with HP 8708A Synchronizer.	$1100.00
608C	10MHz to 480MHz,0-1uV-1V into 50 ohms,AM,CW,or pulse modulation, calibrated attenuator.	$ 500.00
608D/ TS510	10MHz to 420MHz, 0.1uV-0.5V into 50 ohms,+-0.5% accuracy, built-in crystal calibrator, AM-CW or pulse output.	$ 375.00
608E	Improved version of popular 608C.Up to 1V output.Improved stability,low residual FM.	$1450.00
608F	10MHz to 455MHz in 5 bands +-1% frequency accuracy with built-in crystal calibrator.Can be used with HP 8708A Synchronizer. Output continuously adjustable from .1uV to .5V into 50 ohms.	$1100.00
612A	450-1230MHz ,0.1uV-0.5V into 50 ohms,calibrated output.	$ 750.00
614A	900-2100MHz with many features including calibrated output and all modulation characteristics.	$ 500.00
616A/ TS403	Direct reading and direct control from 1.8 to 4.2GHz. The H.P.616A features +-1.5dB calibrated output accuracy from -3127dBm to -dBm.The output is directly calibrated in microvolts and dBm with continuous monitoring. Simple operation frequency dial accuracy is +-1% and stability exceeds 0.005%-/ C change in ambient temperature. Calibrated attenuator is within +-1.5dB over entire output band. 50 ohm impedance unit has internal pulse modulation with rep rate variable from 40 Hz to 4KHz,variable pulsewidth(1 to 10usec)and variable pulse delay(3 to 300usec).External modulating inputs increas versatility.	$ 375.00
616B	Same as above but later model.	$ 600.00
618B	3.8 to 7.6GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 600.00
618C	Same as above but later model.	$2200.00
620A	7 to 11GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 750.00
620B	Same as above but later model.	$2200.00
626A	10 to 15GHz,10mw output power with calibrated output and pulse-square wave or FM modulation.	$4200.00
8708A	Synchronizer used with 606B,608F.The synchronizer is a phase-lock frequency stabilizer which provides crystal-oscillator frequency stability to 450MHz in the 608F signal generator.Phase locking eliminates microphonics and drift resulting in excellent frequency stability.The 8708A includes a vernier which can tune the reference oscillator over a range of +-0.25% permitting frequency settability to 2 parts in 10 to the seventh.Provides a very stable signal that satisfies many critical applications. (With HP 606B or 608F) (Without)	$ 350.00 $ 450.00
EMC-10	ELECTROMETRICS EMC-10 RFI/EMI RECEIVER Low frequency analyzer covering 20Hz to 50KHz frequency range.Extendable to 500 KHz in wideband mode.	$2500.00
NF-105F	Empire Devices Field Intensity Meter. Has NF-105/TA,NF-105/TX,NF-105/T1,NF-105/T2,NF-105/T3. Covers 14KHz to 1000MHz.	$2100.00

ALL EQUIPMENT CARRY A 30 DAY GUARANTEE.

EQUIPMENT IS NOT CALIBRATED.

UNEX LABORATORIES THS-2 FLEXICOM HEADSET.

these headsets come with data to hook up to a ICOM radios and many other equipment.

Perfect for Airplanes , Helicopters , Mobile Radios , or Just the Telephone.

These Are Factory New In Sealed Boxes. Limited Supply Only $69.95

ORDERING INSTRUCTIONS

DEFECTIVE MATERIAL: All claims for defective material must be made within sixty (60) days after receipt of parcel. All claims must include the defective material (for testing purposes), our invoice number, and the date of purchase. All returns must be packed properly or it will void all warranties.

DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

FOREIGN ORDERS: All foreign orders must be prepaid with cashier's check or money order made out in U.S. Funds. We are sorry but C.O.D. is not available to foreign countries and Letters of Credit are not an acceptable form of payment either. Further information is available on request.

HOURS: Monday thru Saturday: 8:30 a.m. to 5:00 p.m.

INSURANCE: Please include 25¢ for each additional $100.00 over $100.00, United Parcel only.

ORDER FORMS: New order forms are included with each order for your convenience. Additional forms are available on request.

POSTAGE: Minimum shipping and handling in the US, Canada, and Mexico is $2.50 all other countries is $5.00. On foreign orders include 20% shipping and handling.

PREPAID ORDERS: Order must be accompanied by a check.

PRICES: Prices are subject to change without notice.

RESTOCK CHARGE: If parts are returned to MHZ Electronics due to customer error, customer will be held responsible for all extra fees, will be charged a 15% restocking fee, with the remainder in credit only. All returns must have approval.

SALES TAX: Arizona must add 5% sales tax, unless a signed Arizona resale tax card is currently on file with MHZ Electronics. All orders placed by persons outside of Arizona, but delivered to persons in Arizona are subject to the 5% sales tax.

SHORTAGE OR DAMAGE: All claims for shortages or damages must be made within 5 days after receipt of parcel. Claims must include our invoice number and the date of purchase. Customers which do not notify us within this time period will be held responsible for the entire order as we will consider the order complete.

OUR 800 NUMBER IS STRICTLY FOR ORDERS ONLY
NO INFORMATION WILL BE GIVEN. 1-800-528-0180.

TERMS: DOMESTIC: Prepaid, C.O.D. or Credit Card
FOREIGN: Prepaid only, U.S. Funds—money order or cashier's check only.

C.O.D.: Acceptable by telephone or mail. Payment from customer will be by cash, money order or cashier's check. We are sorry but we cannot accept personal checks for C.O.D.'s.

CONFIRMING ORDERS: We would prefer that confirming orders not be sent after a telephone order has been placed. If company policy necessitates a confirming order, please mark "CONFIRMING" boldly on the order. If problems or duplicate shipments occur due to an order which is not properly marked, customers will be held responsible for any charges incurred, plus a 15% restock charge on returned parts.

CREDIT CARDS: WE ACCEPT MASTERCARD VISA AND AMERICAN EXPRESS.

DATA SHEETS: When we have data sheets in stock on devices we do supply them with the order.

MHz electronics

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

(602) 242-3037
(602) 242-8916
2111 W. CAMELBACK ROAD
PHOENIX, ARIZONA 85015

Toll Free Number
800-528-0180
(For orders only)

See List of Advertisers on page 114

73 INTERNATIONAL

from page 78

procedure, and a 9-month freeze on issuing new licenses.

There is an increasing interest in VHF, especially 2 meters. Being in Region 1, we are allowed only 144-146 MHz. 146-147 MHz is a popular commercial band since relatively inexpensive amateur rigs can be used on these frequencies. The first attempt at using a 2-meter repeater was in 1978 when a makeshift repeater was set up in Monrovia. It was not very satisfactory, with limited coverage and frequent breakdowns, but it was a beginning. Then the Bong Mine ARC installed a repeater in 1979 at their commercial site on the top of Bong Mountain at 900 feet altitude. It operates on 145.1 in and 145.7 out on a 7.5-dB gain vertical at 20 Watts output. It has five-county coverage (half of the counties) if proper power and antennas are used.

My path to Zorzor (pronounced zaw-zaw) is the longest path of anyone working the repeater. It is 90 miles over hilly/mountainous terrain. I definitely have the most exotic 2-meter antenna in Liberia. With the help of EL2FE, EL2CA, and the *ARRL VHF Manual* and *ARRL Antenna Handbook*, I constructed a vertically polarized rhombic, 58 feet on a side. It is fed with 300-Ohm ladder line and then matched with a universal stub into a 4:1 coaxial balun and a short run of RG-8/U into the shack. The rhombic is unterminated and bidirectional. It is easier to construct that way, and there is a rather unlikely chance that I will ever be bothered by QRM from 3X only 3 miles behind me. This type of antenna might be very useful for an American ham in a rural area with poor repeater coverage trying to get into a distant repeater.

Getting 2-meter equipment in Liberia is a real problem, especially for Liberians. If there are any repeater clubs or VHF enthusiasts that would like to help promote 2-meter activity in a developing country by sending old but serviceable crystal-controlled rigs that are lying around, please contact me.

Tom Viseli EL2AV has done the first OSCAR work from Liberia. On July 12, 1979, he made the first Liberia-US contact using OSCAR 7, which is about the maximum distance possible. Tom lost interest after his initial success since most of the time "there was no one to hear but myself," and since Tom left, there has been no one to fill the vacuum. I have some interest in OSCAR, but time and equipment are the limiting factors

For many years, the West African Net has met on 7.060 at 0700Z on weekdays and 0800 on Sundays. This net is quite active and is mostly EL with some regular 9L and TU and occasional XT, 5U, TY, 9G, 6W, 3X, and maritime mobiles.

Liberia has been independent for 135 years and Liberians were probably the first black Africans to be licensed as amateurs. Historically, the first Liberian amateur was John Lewis Cooper who worked for P&T and was licensed about 1938. It seems that some expatriates may have preceded him by a few years but the history is not clear as to who was actually the first ham in Liberia.

The next group of Liberian amateurs was licensed in the 40s and included Henry Grimes EL2M, Robert Taylor EL2H, and Samuel Butler EL2L. These people are presently alive but inactive. In the 50s came Sewell Brewer EL2S, who presently works for the ITU in Geneva. The longest-licensed, presently active amateur in Liberia is Sam Watkins EL2P, who was first lincensed in 1956. Sam has been a key figure in the success of amateur radio in Liberia as the Assistant Minister for Telecommunications.

Walcott "Ben" Benjamin, Sr. EL2BA is the individual I consider Mr. Ham Radio in Liberia. He has been a powerful force behind amateur radio, acting as president of the LRAA and looking after our interests on the domestic and international scenes. Although a busy businessman, he always has time for amateur radio. He is a member of the IARU Region 1 division executive committee. He was an observer with the Liberian delegation to the WARC in Geneva and was a strong force behind the scenes which made the conference a success. He is constantly driving around the country helping to administer tests, and generously loans his personal equipment to those in need. He often buys equipment from departing hams because he doesn't want to see a good rig leave the country and somebody may need it in the future. He runs the QSL bureau and goes personally to LTC to assist others in getting their first licenses or even to renew their licenses. His list of contributions is unending. He has been licensed since 1968.

Other prominent Liberians are Jacob "Jake" Cisco EL2C, first licensed as EL4E in 1970. Jake is Chief Pharmacist for the Ministry of Health and is the man who helps get drugs for our hospital and many others. Ashley Rennie EL2AR was licensed in 1970 as EL4NA and is Communications Manager for the Firestone rubber plantation in Harbel. Henry Hali EL7E is a chemistry teacher at Cuttington University College in Suakoko. Henry was first licensed as EL5NA in 1971 and is very active on 20 meters.

A promising new addition to the Liberian ham community is Kokulo Waiwaiku, a young doctor from Zorzor who worked with me for a year after graduating from medical school. He was my personal recruit into ham radio. First licensed as EL5NB in 1981 and now EL2CQ, Kokulo is presently specializing in pediatrics in Monrovia.

Steve Mmari EL2EM is a Tanzanian who recently finished his studies in physics at the University of Liberia and is quite active. Steve is one of the few Tanzanians—if not the only one—to have a ham license.

Expatriates like myself have a fairly high turnover and usually stay for only 2-4 years. Americans make up the largest number of expatriates. They most likely would be missionaries like myself or sponsored by the US government, such as Voice of America staff, embassy personnel, and development people. Gale "Lee" Ruff EL2FE is one of the most prominent expatriates and is known as "EL2 Fix Everything." Lee has been in Liberia over 10 years and is the top engineering man at the Firestone rubber plantation in Harbel about 50 miles down the coast from Monrovia.

Operating from Liberia is enjoyable. The country isn't on the 10-most-wanted list, but we are constantly informed that we are the first EL contact, and prefix hunters go crazy with EL5 since there are only three of us. Pileups can be generated quickly when there are strong signals during popular operating times, especially with Europe and Japan. The best operators in a pileup are the Japanese, North Americans, and northern Europeans, in that order. The worst are the southern Europeans, eastern Europeans, and South Americans, in that order; operating under heavy pileup conditions with southern and eastern Europeans is impossible without operating split, and often I just shut down. However, unbelievable pileups can be handled without a problem on simplex with Japanese stations.

When signals aren't strong and during off operating hours, often you can call CQ without an answer, or generate a short string of QSOs which trail out and stop (are you listening QRPers?). Fortunately, we aren't so rare that you can't make a QSO with your buddies without being interrupted. We are, however, often asked for signal reports during short breaks, which is not too bothersome.

Stateside propagation is most reliable on 20 meters between 2100 and 0800. I usually keep a sked with my QSL manager, K3RB, at 2200 with universally good results. 15 meters can often be good during those times but drags out a little later in the morning, and quite reliable skeds can be kept at 1100 on this band. The problem with 15 and 20 meters is that they get good when a working family man should be in bed. That's why you hear Africans protesting all the time that they want to go to bed. When 10 meters is open it is usually between 1100 and 1900. On 40, 80, and 160 meters, nighttime is, of course, the best chance for DX, and to the US it is usually early morning before sunrise (0300-0600). Heavy QRN in the tropics quickly dulls your enthusiasm for the low bands.

There can be some nice long-path openings on 20 meters, usually into the West Coast, between 1300 and 1800. I ran a beautiful patch on 1400 MHz by this route recently to my brother-in-law in California. The band is more consistently open into the Pacific, and I once ran a patch into Guam at about this same time.

Other interesting openings include the very consistent 20-meter path to the Pacific and long-path VK at 0700-0900.

Walcott "Ben" Benjamin EL2BA, Kokulo Waiwaiku EL2CQ, and Steve Mmari EL2EM during an antenna-raising party for Kokulo (who erected a home-brew quad on a home-brew guyed tower).

Larry Johnson EL5F is seen here operating Yaesu equipment in his bedroom. Larry is translating the Bible into Kisi, which is the same ethnic group that Henry EL7E comes from. These two guys are certainly the only hams to ever carry out a QSO in Kisi.

Oscar Ocampo EL9A is a Filipino who keeps a regular sked with his DU buddies on this long-path opening. Sometimes there is an unbelievable pipeline long-path into JA at this same time on 15 meters. 15 is good to Africa and Asia in the afternoons between 1600 and 2000. People don't realize how close Liberia is to Brazil, and there can be some tremendous signals from PY on any band at almost any time. EA8 puts in crushing signals. The bands seem to be open almost always to Europe, which is a piece of cake. ZL is over the South Pole and for some reason is difficult to work.

We have ten call numbers. Each of the nine counties is designated a number 1 through 9. (Keep in mind that Liberia is a small country about the size of Indiana and has only 2 million people.) Most hams are in Montserrado County, which is EL2 and includes the capital, Monrovia. My county, Lofa, is EL5. It is the largest in the country and is nearly the size of Massachusetts. The LRAA offers a Worked All Liberia Award (WAEL) if you can confirm all 9 counties with contacts on at least 3 bands. It is not that easy, as all the counties are not presently active.

EL0 is maritime mobile since Liberia has a very large merchant marine. There are only a handful of EL0s and the suffixes all begin with A. Most EL0s are bootleggers; and they usually pick a callsign which *doesn't* begin with A, so they are easy to spot.

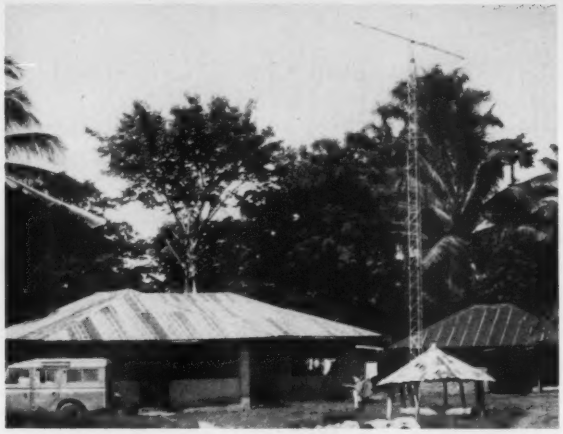
My position as Chief Medical Officer at Curran Lutheran Hospital in Zorzor is very challenging. Our hospital was started in 1924 and has 120 beds. It is hard to imagine, but there wasn't even a road to Zorzor until 1958.

My training is as a specialist in internal medicine, but my job includes everything that walks in the door including surgery, pediatrics, obstetrics, public health, and even chemotherapy. Other things, not usually included in a doctor's job description, include creating a home-made solar water heater, maintaining 15 old Heathkit/HF mission radios, repairing electrocardiographs and spectrophotometers, designing and supervising construction of buildings, and almost anything else.

Amateur radio is a great hobby and has proven to be invaluable for the hospital as well. We have had emergency situations caused by breakdown of critical equipment such as an autoclave for sterilizing surgical instruments. The generous phone-patch assistance of US hams has gotten replacement parts to us in as little as seven days rather than the 2–3 months that conventional methods would take. Another occasion where ham radio saved the day involved a severe eye injury to a blacksmith caused by a splinter of iron (wear your safety goggles). A phone patch to an opthalmologist in Pennsylvania allowed my colleague and I to perform eye surgery which saved the man's eyesight.

Our hospital has a long tradition of ham radio over the years. The maintenance chief in 1972, Dave Urfer EL5B, ran emergency communications with the Centers for Disease Control (CDC) in Atlanta during that year's Lassa fever epidemic which killed 4 people and left 2 completely deaf. This won him a medal from the Liberian government and a page in *73* magazine. Four other doctors who have worked at the hospital are hams.

Hamming is a relaxing hobby for me, and I enjoy construction projects, low-key DXing, and rag-chewing. It is also amazing what help a guy can get if he only asks another ham. If I have a technical problem, I can usually find the answer, anything from aircraft antennas to castrating pigs for a local agricultural project.

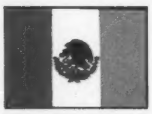


QTH of Larry Johnson EL5F, which is located in Boya less than half a mile from the Sierra Leone border. Boya is about a 5-hour drive from Zorzor when the roads are passable.

My HF rig is an Icom 720A which I recently acquired from a departing ham. I have found it to be as nice as it looks. It doubles as a general-coverage receiver and allows me to pick up football games and my favorite radio program, "All Things Considered," via the Armed Forces Radio and Television Service (AFRTS). It also serves as a frequency standard for my workbench. I have a Clipperton L amplifier which really helps, but it just blew a transformer and I'm waiting for the $145 replacement. I brought a Heights 64-foot, aluminum, foldover tower with me and use a Mosley CL33 tribander at the top of the tower. There is an 8-element quagi on a 4-foot mast above the tribander. I use a half sloper on 80 with a trap for 40 meters. I made a half sloper for 30 meters but was unable to get the swr down satisfactorily, so I am working on a rotatable shortened dipole. My vertically-polarized 2-meter rhombic for repeater work is 109 feet front to back and stands off the side of the tower.

The hospital has two 75-KVA Caterpillar diesel generators which supply electricity to the hospital compound. Diesel fuel is $3.00 a gallon, and spare parts are expensive and difficult to get. We presently have fairly reliable power for 21 hours a day, but I run my complete station except for the HF linear amplifier from a 120-Amp-hour battery with a 10-Amp battery charger. This gives me uninterrupted hamming enjoyment.

I hope you have enjoyed this ham-radio tour of Liberia! On behalf of the vigorous amateur community in Liberia, I invite you to work us on the bands and learn something more about our country.



MEXICO

Mark K. Toutjian XE1MKT
Apartado Postal 42-048
06470—Mexico, D.F.

Photos by Gabriel Stadtler

According to Aztec mythology, Teotihuacan is where the gods came together to create the sun and the moon. A giant pyre was made and the poor but brave god, Nanauatzin, threw himself fearlessly into the sacrificial fire, thus becoming the sun. The richly-dressed Tecciztecatl, who had boasted of his bravery, hesitated before casting himself into the flames and thus became the pale moon. His light was now only a reflection of the sun's rays. From this legend came the names of the two largest pyramids of Teotihuacan, also known as "The City of the Gods."

Teotihuacan is the most widely known of Mexico's major archeological zones. Located about 42 miles northeast of Mexico City, the area covers 91 square kilometers. There you will find majestic pyramids of all sorts, temples, and courtyards. Some archeologists estimate that Teotihuacan had some 125,000 people living there, making it one of the largest cities in the world of its time—in the third century BC.

It was more than 2,300 years later that my XYL (Ruth XE1RBT) and I obtained special permission from the National Institute of Anthropology and History in Mexico City to occupy the top of the Pyramid of the Sun (65 meters high) for a 24-hour QSO. We asked for the date of February 12, 1983—our sixth wedding anniversary!

What a way for a married couple of hams to spend their wedding anniversary! Within all those QSO pileups there would certainly be someone who would ask why—and we would be able to answer (and delightedly remind ourselves) that it was just for the fun of it!

The first obstacle that we had had to overcome was getting permission to undertake this expedition to the archeological zone. There is nothing like doing things properly right from the very beginning, so a detailed written petition was presented to Lic. Pablo Elhore Garcia, Director of Legal Matters for the National Institute of Anthropology and History in Mexico City, and Emigdio Arroyo Garcia, Administrator of the Teotihuacan Archeological Zone. The matter was considered and, fortunately for us, approved! Then the real fun began!

February 12 was a Saturday, so we decided the 24-hour QSO would begin that day at 8:00 am and end on Sunday, February 13, 1983, at the same hour. Picture rights were obtained by the Institute, camping equipment was purchased at once, and Gabriel Stadtler (a good close friend of ours) got his camera equipment together and started making a study so as to capture our DXpedition on film, step by step, for *73* magazine (and for our family album, filed under "wedding anniversaries," with the theme: "Just For The Fun Of It"). I made out my list of the radio equipment and antennas that I would be using.

It just so happened that around preparation time I got together a parasitic beam that Ralph Bilal WD0EJA made especially for me in order to work the 15-meter band. I had never before owned a parasitic beam or any other antenna that works by inductance. Results: excellent! I was completely satisfied with its performance, especially because I could cover the entire band and stay within a 1.5:1 swr. This three-element, 15-meter parasitic beam has a coil on each end of the elements. Each is a 15-meter antenna in itself. There is the driven element that is excited directly through the transmission line (50-Ohm coax). The other two elements, each with its antennas, are parasitic and work by inductance from the driven element. The array is a combination of six 15-meter antennas, two on each element. Each antenna is tuned separately by moving the stub on the end of the coil until the lowest swr is reached on a designated frequency. The other five antennas have to be disconnected in order to tune up each one separately.

When all six are tuned up, they are connected up again and you have six 15-meter antennas working on just one beam! The boom is 8'2", excellent for Field Day use without getting into the "big array," and is made out of 7/8" aluminum tubing. The

DXpeditioners (left to right) Jesus, Leobardo, Daniel, Freddy, Gabriel (photographer), Mark XE1MKT, Ruth XE1MKT, Elvia, Lizzy, Wendy, Joe, Renee, and Chris.

Thawing out early Sunday morning on top of the Pyramid of the Sun, with sunrise in background.

Returning to ground level.

elements are around 12" long, with the radiating capacitor at the end.

Ralph manufactures three standard Isotron antennas and makes antennas for other spectrums of the 20-meter band for individuals who request them.

Thinking of the cold weather and possible battery-power loss during our 24-hour QSO, I worked on getting together a battery charger, using a small gasoline engine, voltage regulator, and alternator. However, time was pressing and I couldn't locate the gasoline-powered engine, so, knowing of the high winds on top of the pyramid that we would later climb, I mounted fan blades to a wooden structure along with the alternator and voltage regulator. However, our two 12-volt car batteries were enough, and I did not suffer battery loss. We did not have to use the charger system although we could have: When we first reached the peak of the Pyramid of the Sun, winds were high and so were the revolutions of the make-shift contraption that I called an emergency charger.

The day finally arrived for our expedition and we set off to Teotihuacan. With the help of local officials of the archeological zone there, our initial campsite was sought out, ending up right at the rear base of the Pyramid of the Sun. The pyramid stands 65 meters high, although originally, with a temple located up on top, it was said to be 10 meters higher. It has a volume of one million cubic meters, and each of its sides is 225 meters long at the base. Its main facade is situated 15°30' east of the astronomic north.

There we set up our tent and the boys and I got to work on our antenna setup. Ralph's parasitic beam was immediately put together, mounted, and tuned up. I used a two-piece, 9-foot television antenna mast. On its point we mounted a Ringo Ranger two-meter vertical antenna (made in Mexico). Well, there we had it for 15 and 2 meters, so up with the half-wave dipoles, using Hy-Gain's 1:1 baluns, for 40, 20, and 10 meters. We used a few local tall trees to hang them between.

Our permit was for us to transmit from 8:00 am until 9:00 pm within the archeological zone. I was told that over 30,000 tourists visit the area in just one day! So I discreetly began my 24-hour QSO at the back side of the Pyramid of the Sun until visiting hours were over. Then at 7:00 pm there was the first of two beautiful sound and light spectacles that take place twice nightly (except Mondays and mid-October to mid-May). We had to wait until 9:00 pm, therefore, to make our climb to the top and set up camp there, leaving part of our expedition group at our base station with two-meter equipment (Kenwood's TR-7850 and two handie-talkies, one Kenwood TR-2500 and an Icom IC-2AT) for our own intercommunication.

Running in front of the Pyramid of the Sun and leading right to the Pyramid of the Moon is the Old Road, or Highway of the Dead; it was named as such because many human skeletons have been discovered along it. That was our entrance way to the stairs of the Pyramid of the Sun at 9:00 pm, sharp. High winds and cold air greeted us as the six of us slowly made our climb to the peak, loaded with camping gear, radio gear, antennas, transmission lines (feedlines), 12-volt batteries, my "emergency wind-powered charger" contraption, food, serapes, and heavy clothing. A local official from the archeological zone was assigned to stay with us all night long. Another was kind enough to illuminate the entire 65-meter-high stairway with an airplane headlight that he had mounted to his pickup. Good old "Jose Luis" was there when we needed him the most! The Teotihuacan tribe had built these pyramids with some dangerously-steep stairs. Our aim was not to look back until we had made it to the top!

After a few rest stops we made it to the peak, quickly got organized, and began setting up the tent and the antenna system. Have you ever tried erecting a tent and a 9-foot mast with antennas up on top of a 65-meter-high pyramid with high winds in freezing weather? Tent rope was stretched out to different angles and wrapped carefully around protruding blocks of the pyramid (you just don't start pounding tent stakes into a 2,000-year-old archeological monument). We had to be extremely careful not to deface the site in *any* way.

That was just half the fun. Once the tent was set up, we took turns holding up the 9-foot mast as two others tied down the ends of the dipoles, using them as guying wires as well. The others thawed out some within the tent until it was their turn! Oh, what fun! (We saved ourselves plenty of work by using the dipoles on the mast as guying wires. We used the U-clamp provided by Hy-Gain with the 1:1 balun, fastening the balun to the mast one way and the other balun crossing over for a four-point counterbalance when all was tied down.)

"OK, *everybody* inside now!" was shouted. There was a quick scramble for a good spot in the tent as I announced over 2 meters to the group below and other local hams that the continuation of the 24-hour QSO would begin.

After wrestling for so long with those high winds and cold weather, to our surprise everything calmed down suddenly and we had a quite unusual silence until early morning, with the exception of those wonderful sounds carried over to us through radio wave activity!

It was one pileup after another! Real fine propagation! I had some nice conversations on 20 meters with stations such as VK3AQN (Fred in Melbourne, Australia), ZL2AJR (Gordon in Waikanae, New Zealand), and TI2MAO (Miguel in San Jose, Costa Rica), and on 10 meters, with KP4AAN (Pedro in San Juan, Puerto Rico), HK1ESZ (Edward in Cartagena, Colombia), WA4JUP (John on Merrit Island, Florida), and VE3IPP (Bob in Toronto, Canada). We QSOed with dozens of states in the US on 40, 20, 15, and 10 meters and had pileups from islands near Japan and off South America.

Upon scanning the bands, I came across one of those Mideast broadcasting stations playing some eerie chanted music. Up on top of the Pyramid of the Sun about 3:00 am, it produced a most unique setting. I didn't want to be selfish, so I transmitted it on two meters for the group

Mark K. Toutjian XE1MKT works 2 meters, using Kenwood's TR-2500 handie-talkie; the Pyramid of the Moon is in the background.

down below us and just about scared them to death!

Early Sunday daylight on February 13, 1983, came around quick. It was beautiful to see the sunrise over the horizon of Teotihuacan, the City of the Gods, as I concluded my 24-hour QSO "poco a poco." I'd get to joking and even be a little silly on the air with my fellow hams around the world. "Hey! Did you hear the latest Mexican weather report? Chile today and hot tamale!"

We got to thinking about what response or reaction we would have had if ancient Teotihuacan tribes were still living there and saw us transmitting from their temple area on the high peak of their Pyramid of the Sun. (All we were lacking was a time machine manufactured by Kenwood or some other serious-minded manufacturer!) One thing for sure, we would have had no complaints of TVI! We were comforted by the thought that the Teotihuacans were not a violent, but a peaceful tribe compared with others such as the Aztecs, known for their sometimes thousands of human sacrifices each year!

I'm not Speedy Gonzales on the air. I enjoy being conversational with others. For me, that adds the fun to ham radio. I meet and get to know different ones who become real friends, and I have enjoyed long-lasting friendships over the air from all over the world. That's the name of the game for me. I do it just for the fun of it.

We finally left our fine abode on the Teotihuacan Peak, and I'll never forget that hot cup of coffee that awaited me down below or that last celebration, ended by saying adios to our amigos at the famous City of the Gods.

Future DXpeditions may await us here in Mexico, since the country itself is full of original sites such as the famous volcano, Popocatepetl, or Silent Valley, Durango (where astronomical expeditions are held). Mexico is a country with a wide variety of beautiful and unusual settings for field days or technical operations for amateurs. Come on down whenever you wish! Organize a DXpedition as we do—just for the fun of it!

THE NETHERLANDS

Henk Meerman
Zandvoorterweg 33
2111GR Aerdenhout
The Netherlands

Sponsored by many local hams, a brand new repeater for two meters is now on the air in the Netherlands. In a small country like ours, a new repeater is quite an event.

The repeater, homemade by Ari Bol PA0QHN, operates on 145.775. The machine is now located on top of an old water tower near Heemstede, and it covers the midwest area of Holland; its callsign is PI3HLM. Now almost the whole country is covered by VHF repeaters, with a total of 19!

The club station PI4HLM of the NCV (a Dutch radio society) will be on the air this year on the 29th and 30th of October, on all bands. Maybe a good tip for special prefix hunters.

In our country of wind and water, it is easier to get a ticket for amateur radio than one for operating one of those old windmills we have. We have four license categories: A, B, C, and D. The easiest way of getting involved is to pass an exam for a D license. It requires only a basic technical knowledge and no code. With a D license, you are allowed to operate a 15-Watt FM rig from 144.9875 to 145.800 MHz.

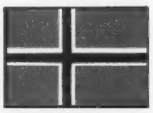
The next step you can make is to get a C license; it takes a little more technical knowledge but still no code. When you pass this exam, you are able to operate on all bands above 144 MHz in all modes and with a power output of 30 Watts. Due to the introduction of the D license, the two-meter band is very popular in Holland.

Most of the Dutch hams use Japanese rigs, but there are also many guys who work with homemade equipment or converted ex-army and surplus machines.

In Holland, there are three major amateur radio societies: VERON, which is the Dutch section of the IARU, PO Box 1166, 6801 BD, Arnhem, The Netherlands; VRZA, at PO Box 61420, 2506 AK, The Hague, The Netherlands; and NCV, PO Box 2999, 2002 RZ, Haarlem, The Netherlands.

The VERON also has a special club for female hams called the Dutch YL Club. It is there to encourage women to get involved in the hobby, keep contacts with other YLs around the globe, and join in to organize special contests. Address the DYLC at Ir Lelylaan 69, 2103 HN, Heemstede, Holland.

So, if you have any questions, or something you would like to know about amateur radio in Holland, you can write to them. (Don't forget an IRC for return postage.)



NORWAY

Bjorn-Hugo Ark LA5YJ
Postboks 39, Manglerud
Enebakkveien 208
Oslo 6, Norway

REVISED RULES FOR WALA

"Norges-sertifikatet"—Worked All LA—is available to licensed radio amateurs and SWLs all over the world. Contacts with LA and LB stations made after January 1, 1950, are valid for the award. The required number of contacts must be worked from the same QTH, within a radius of 100 km.

Requirements for HF: Applicants in Denmark, Finland, Faeroe Islands, Iceland, Sweden, and Norway must produce evidence of two contacts on separate bands with each of the 19 counties (fylker) of Norway. Applicants in the rest of the world must produce evidence of one contact with each of the 19 counties on any band.

Requirements for VHF/UHF/SHF: Applicants in Denmark, Finland, Sweden, and Norway must produce evidence of contacts with at least 16 of the 19 counties. Other applicants must produce evidence of contacts with at least 12 of the 19 counties in Norway. Contacts via repeater or satellite are not valid.

Contacts may be made on all legal modes. Crossband contacts are not allowed. WALA may be endorsed as appropriate. Contacts with arctic stations (JW or JX) count for the award. Such contacts may substitute county W, X, or Y.

The counties of Norway are A—Oslo, B—Østfold, C—Akershus, D—Hedmark, E—Oppland, F—Buskerud, Z—Vestfold, H—Telemark, I—Aust-Agder, K—Vest-Agder, L—Rogaland, R—Hordaland, S—Sogn og Fjordane, T—Møre og Romsdal, U—Sør-Trøndelag, V—Nord-Trøndelag, W—Nordland, X—Troms, Y—Finnmark, JW—Svalbard/Bear Island, and JX—Jan Mayen.

The application shall include a list of the stations worked and must be accompanied by QSL cards or the following information extracted from the QSL cards and verified by an officer of the applicant's national radio amateur society: date and time UTC, callsign, signal reports, and QTH of the station worked. Other relevant information may be necessary if endorsements are required.

The fee is N.kr. 20 or 10 IRCs and applications may be sent to the Norwegian Radio Relay League, PO Box 21 Refstad, Oslo 5, Norway, or to the NRRL Award Manager, Erik Jahnsen LA7AJ, Kaupangruta 21, N-3250 Larvik, Norway. Applications will be accepted until December 31, 1985.

DIPLOMA HUNTERS

Last month was about DX and reciprocal licensing, but what about Norway itself for those not too interested in DXing directly? Is there anything to gain for the diploma hunter? Yes, indeed there is. One is WALA, described above. Absolutely the same as Worked All States, WAS, from Norway (maybe a little harder, since there are only 4000 amateurs in Norway). This one could be something for the diploma hunter looking for a real "goodie." Then when you have accomplished the difficult job of working them all, try for an 80-meter endorsement—or what about 5 bands? You surely will have some great times ahead of you.

Where do I find LA stations, you may ask. Well, 20 meters is a good place to start. Around 14.325-.300 MHz, you will hear the Norwegian MM net. Many LAs check in there. SAC, the Scandinavian Activity Contest, is one. By the way, the LAMM net is usually active in the late evenings UTC, or between 2000 to 2400. 40 meters early morning UTC is another good time, and of course I am sure many of the LA boys will be happy to give a call on 2 meters to give you a hand with a couple more counties. Have a good time, and good luck.

PAPUA NEW GUINEA

Siegi Freymadl P29NSF
PO Box 165
Rabaul, Papau New Guinea

In Papua New Guinea, amateur radio licensing is handled by the Radio Branch of the Post and Telecommunication Corporation. The postal address is PO Box 3783, Port Moresby, National Capital District, PNG. The matter of reciprocal licenses is at present being sorted out. PNG has reciprocal agreements with member countries of the Commonwealth as well as Switzerland and the United States of America, but Japan, France, and the Federal Republic of Germany have not replied to approaches from PNG. Singapore has advised that individual applications will be considered.

Visiting amateurs from these countries will receive a permit to operate in PNG upon presentation of a photocopy of entry visa, photocopy of the relevant page in the passport giving details for identification purposes, and a photocopy of the amateur operator's certificate and current license. A resume giving details of residence and employment over the past 10 years is also required of the applicant. If a visiting amateur presents himself at the Radio Branch with all this information, he will be able to walk away with a permit to operate.

Amateurs who are coming to Papua New Guinea to take up employment are required to submit the same information as visitors. They will then be given permission to operate and a license will be issued after about one month.

As far as maritime mobile operation is concerned, the situation is that when a yacht enters PNG waters it is allowed to operate MM P29, following written application.

While PNG honors licenses obtained in the USA, the reverse does not apply. It appears that an agreement at an intergovernmental level is needed.

The minimum age for an amateur to be granted a license in P29 is fourteen.

News has been received from Keith P29QA at Arawa, Bougainville Island, that 6m activity was very good during April, when he contacted a number of Japanese stations. Bob P29NBF can at times be heard operating aeronautical mobile at 35,000 feet from his company's new 11-seat jet.

Probably a great deal has already been written about the ill-fated Spratly Island DXpedition. However, as I became involved also, I feel that I should set down my experiences.

On 16 April from approximately 1000 GMT, I began to operate on 15m beaming towards Europe, as I frequently do. Signals were excellent and the response very good. At that time, I was blissfully unaware of the Spratly Island DXpedition or any of the events surrounding it.

At 1028 GMT, I was called by a station giving a UK0 callsign who then informed me that a Russian ship had rescued four persons from a boat and that these people had been placed in a hospital in Siberia and were receiving medical treatment. He added that he could not give either the names of the people or the name of the yacht for security reasons. He requested that I pass this information on to the MM Net on 20m. I repeat once more that I then had no idea of the happenings in the South China Sea.

As my license does not permit me to operate on 20m, I was going to ask either Shirley P29SM or Phil P29PM, who were staying with us at the time, to pass on the information. However, before I could do this I was called by Phil VS6CT, who told me to disregard the message as the OM who had passed it on was a well-known pirate who was in the habit of spreading bogus messages. I left it at that and continued to work European DX, but the UK0 station kept on interrupting and repeating the already-mentioned information. Finally, he became very abusive towards VS6CT, and as I was not willing to put up with this sort of QRM any further, I went QRT, not a little bemused.

The following morning, our Sunday (2352 GMT Saturday), I was talking to some of my Australian friends when I was again called by Phil VS6CT. Phil then filled me in on all the events regarding the Spratly Island DXpedition and the yacht *Sidharta* up to that date, as they were known to him. VS6CT and N0ZO/DU2 and a number of other stations had maintained contact with the yacht up to its disappearance and since then had kept a round-the-clock watch on the amateur bands, hoping to pick up signals from the *Sidharta*.

The last transmission received had been at 0652 GMT of April 10 on 14.320 MHz, and it was "fire on board." Phil, who was on vacation and due to start an overseas trip, spent most of his days monitoring the bands for a signal from the yacht. He and other amateurs were plagued by bogus distress messages, and a great deal of effort and money had been expended in following up the information while the fate of the yacht and survivors remained unknown. Phil also mentioned

that the OM who had used the UK0 callsign the previous evening had also been known to use a YB callsign. He is easily identified because of his gravelly voice.

Following this QSO, I called in on the VK4 WIA talk-back, passing on details of the events and the callsigns used by the pirate.

About a week or so later I heard that four survivors had been picked up by the Panamanian freighter *Linden* which was on its way from Singapore to Hong Kong. The *Linden* picked up the survivors from the *Sidharta* who had taken to their life raft after being fired at on April 10. One of their group was killed instantly and one was wounded and died some days later in the raft. He was buried at sea. They had been adrift for nine days when the *Linden* sighted them near Amboyna Cay of the Spratly Group of Islands.

Therefore, the information given to me on April 16 by the pirate was a hoax and in very bad taste. This and the bogus CW distress signals caused a lot of people a lot of work and expense, all to no avail. One wonders what could motivate anyone to stoop so low as to deliberately spread false information.

See you next month!

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3, Poland

VERIFICATION

On the memorable day of December 13, 1981, use of amateur radio equipment in Poland was forbidden. Possessors of transmitters and sending-receiving devices were obligated to place their equipment on deposit in 48 hours, and their licenses became void. Polish hams ceased to modulate the ether with their signals.

After martial law went into force, other activities of the organization uniting Polish radio amateurs—Polish Radio Amateurs Association (PRAA)—did not cease. The Technical Commission of PRAA began to develop plans for modernizing the equipment used by Polish hams.

A harbinger of a change for this long-lasting hush in the ether came flying on October 23, 1982. On that day, the meeting of the Presidium of PRAA took place in Warsaw. The first action undertaken brought up to date all suspended licenses. As a first step, the main Verification Board at PRAA was called into being. After the meeting of the Presidium of PRAA with presidents of district departments of PRAA, held in Warsaw on November 8, 1982, District Verification Boards at PRAA were in the making. It was decided to enter upon the subject outright. But...one swallow doesn't make a summer.

Every member of PRAA—there are no radio amateurs in Poland who do not belong to PRAA—who would like to have his license brought up to date was to complete a letter of application filling out printed forms in duplicate, edited by PRAA. An applicant was to bring to light details of his former activity in PRAA, command of foreign languages, membership in organizations, and so on.

Letters of application would be assessed by the local club of an applicant. Completed forms would be handed over to the District Verification Boards that once more would pass their opinions. District Verification Boards then would turn them over to a District Inspectorate of State Radio Surveillance.

The presence of applicants at meetings of District Verification Boards will not be necessary. In some cases the board may demand logbooks of radio stations or received QSL cards as evidence of previous activity. License updating will last to the end of 1983. Those who don't submit before the day of expiration and want to regain licenses must apply in compliance with obligatory rules, as if they were applying for the first time.

The first sitting of the main Verification Board took place in Warsaw on November 23, 1982. It was there announced that District Inspectorates of State Radio Surveillance will receive instructions relative to investigations of applications. It was decided to first investigate applications of the members of the Head Radio Board—a new body in PRAA that will take care of complying with the rules binding radio amateurs. Their District Verification Boards have begun their work in most districts of Poland.

All Polish radio amateurs are waiting for the moment when the Polish sky will sound with their callsigns and they will be able to establish contacts with their old friends.

THAILAND

Tony Waltham HS1AMH
c/o Bangkok Post *Newspaper*
968 Rama IV Road
Bangkok 10500
Thailand

The latest issue of the international *Callbook* testifies to the popularity of amateur radio in Thailand, with some 510 radio amateurs listed and the number growing all the time. But what the *Callbook* listing does not demonstrate is the vast upsurge in interest in radio as a hobby, largely due to a pilot project begun two years ago by Thailand's Post and Telegraph Department.

It was then that the PTD began what it regards as a forerunner for full amateur radio licenses on a broad basis by granting permission for Thais who have passed a written test to own VHF transceivers and operate on spot frequencies in the two-meter band. HS callsigns were *not* granted, however, and the operators received a number, preceded by the letters VR, standing for volunteer radio operator.

Many of these VR operators—who now number over 600, along with a waiting list of others who have passd the test—also hold the HS callsigns found in the *Callbook*, and some are well-known operators internationally.

Thus there are a large number of Thai radio-hobby enthusiasts who can be met, in Thailand, only on the calling frequency of 144.500 MHz—but for the time being by other Thais only, as no foreigner has yet to be granted this status.

Many ask where Thailand is on the HF map these days. Recently, Thailand used to be the only country active in Zone 26, and not a few anxious DXers are seeking a contact with Thailand while Burma, Laos, Cambodia, and Vietnam stay QRT for their own differing reasons.

The Thai PTD is currently reviewing the status of amateur radio, and previously-active amateurs still possess licensed HF equipment—on the condition that they do not operate unless granted special permission for the time being. For those eager for an HS contact, the best suggestion was to listen out during the JARL-organized All-Asia DX contest in June or during the SEANET (Southeast Asia Net) contest which was to be in August. The station was to be signing HS0HS, and probably chalked up close to 3,000 contacts if past performance is any indication.

Last November's SEANET Convention was hosted by the Radio Amateur Society of Thailand (RAST) in Bangkok, and some 100 hams from overseas attended to hear several eminent speakers, including ARRL Vice President Carl Smith and 73's very own Wayne Green. Events included a trip out to the VOA one-megawatt medium-wave transmitting facility just north of Bangkok, as well as the usual eyeballing and display of equipment.

Next year's event will be held in Singapore from November 18 to November 20, and those seeking further info can write to the Singapore Amateur Radio Transmitting Society or, propagation willing, tune in to 14.320 MHz daily, the Southeast Asia Net frequency. The net begins at 1200 UTC with net control usually in BK2, VS5, VS6, or 9V1. It is not a DX net, but any station desiring to contact a check-in may call "contact" and the NCS will assign them both a clear frequency as standard net procedure.

WEST GERMANY

Ralf Beyer DJ3NW
Opferkamp 14
3300 Braunschweig
West Germany

WARC BEAM ANTENNAS

The Federal Republic of Germany was one of the first countries where radio amateurs were allowed to operate on the new 10-, 18-, and 25-MHz bands. Foreseeing this development, antenna designers in this country were at their drawing boards right after WARC '79. First designs for new beam antennas were presented in 1980. After some refinements, production began in 1982. It is interesting to see what is available today and how to plan ahead regarding antennas in those places where the new bands are yet to be opened.

One manufacturer, the Kurt Fritzel Company (Sonnenwendstr. 41, 6702 Bad Duerkheim), offers a whole range of trap-beam antennas. Let's look at some of the design principles and their implementation. They decided initially that the size of the largest beam should be 11 × 7.5 meters. This corresponds to the size of a 3-element monobander for 20 meters, which constitutes an upper limit for the average ham regarding installation, maneuverability, and appearance of the antenna. However, in the course of the optimization process, they ended up with a boom length of up to 10 meters. Such a length was needed for their largest antenna, a 7-element/6-band beam. They also decided to interlace two 3-element beams for 10/18/25 MHz and 14/21/28 MHz, each with its own coax feedline, in order to achieve 6-band performance. Conventional 3-element trap-beams with a boom length of approximately 5 meters thus can be upgraded by interlacing it with a new 10/18/25-MHz beam. Calculations showed that a 6-band trap-beam with only a single feedline would have required 10 traps for the radiator, which could not be accommodated mechanically.

Four types of beam antennas are illustrated here as examples to demonstrate essential features of their respective class. Fig. 1 is the conventional 3-element/3-band design adapted for the new bands on 10/18/25 MHz. With a boom length of 7.5 meters and a length of the longest element of 10.3 meters, the UFB 33 beam covers an area of 77 square meters—twice as large as the conventional beam. Three elements are active on each band and a gain of 7/8/6 dB compared to a dipole is claimed. The price of 872 DM (US$350) is about 25% higher than for the conventional 3-element/3-band beam.

For only 93 DM (US$38) more, a 4-element/6-band beam for 10/14/18/21/25/28 MHz is offered with the same length of the longest element and the boom length reduced to 5 meters (Fig. 2). The peculiarity of the FB-DX 460 beam is that it has 3 active elements on the conventional bands but only one active element on the new bands. Hence, a gain of 0/7/0/8/0/7 dB compared to a dipole is claimed. However, this antenna gives

Fig. 1.

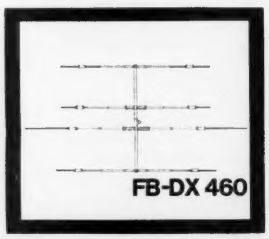


Fig. 2.

Fig. 3.

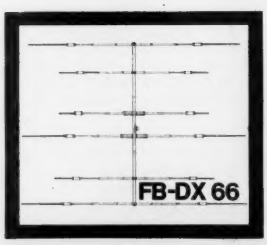


Fig. 4.

6-band performance, is not much larger, and with a price of 965 DM (US$386) is "only" 40% more expensive than a conventional 3-element/3-band beam.

It is surprising to note that for almost the same amount of money, a 4-element/6-band beam (FB-DX 406), with longest element/boom dimensions identical to the FB-DX 460, is available. However, this antenna has 2 active elements on each band and offers a gain of 5/5/4.5/4.5/4/4 dB on the 6 bands when compared with a dipole (Fig. 3).

A typical representative of the upper class—6-band performance comparable to the conventional 3-element/3-band beam—is the FB-DX 66 (Fig. 4). With a length of the longest element of 10.3 meters, a boom length of 8.75 meters, 5 active elements on 18/25 MHz, and 3 active elements on all other bands, it offers a gain of 6/6/9/7/9/8 dB on 10/14/18/21/25/28 MHz compared with a dipole. But with a price tag of 1590 DM (US$636), it is more than twice as expensive as the conventional 3-element/3-band beam and costs as much as two separate beams for 14/21/28 MHz and 10/18/25 MHz. But remember, interlacing of the existing 3-element/3-band beam for 14/21/28 MHz with a new beam for 10/18/25 MHz, e.g., the UFB 33, may be possible in order to achieve the same performance at half the price.

Other characteristics of the UFB 33/FB-DX 460/FB-DX 406/FB-DX 66 antennas are: turning radius, 6.5/5.2/5.7/6.5 meters; weight, 23/22/23/38 kilograms; and wind load at 135 km/h, 670/810/840/1200 Newtons.

Trapless beams with up-to-7-band performance (including 40m) are offered by another German manufacturer (W. A. Sommer, Kandelstr. 35, 7809 Denzlingen). But the few examples discussed here illustrate quite well some basic alternatives which are available today for the average ham. And now, what can be expected in the future from the US, Japan, and other parts of the world?

SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S-155 00 Nykvarn
Sweden

SSA ANNUAL MEETING

Sundsvalls Radioamatorer, Club SK3BG, hosted this year's annual meeting of the national league, Sveriges Sandareamatorer (SSA), on the last weekend in April.

This was an opportunity for the members to get together, meet their representatives in the league, and express their opinions at the meeting. Also, of course, the major dealers in ham equipment were exhibiting and selling their goodies, and the Saturday night dinner dance is a nice way of getting to know each other better.

Sundsvall Radioclub had arranged everything under one roof. It was a pleasure to enter the hotel room and to find beautiful flowers, chocolate, and refreshments as a gesture of welcome from the club. Sunday is reserved for the meeting that usually ends by early afternoon, after which many must drive several hours to get home.

Saturday, however, is a busy day for everybody. This is the opportunity to get an eyeball QSO with an old-time friend with whom you have talked over the radio for years but never met personally.

Sundsvall should be well-known to every active DXer. It is the home town of Erik SMØAGD, a member of the DX Hall of Fame. Sundsvall DX Group handles his QSLing and they also do their own DX-peditioning, of which the most recent is the J5AG operation from Guinea-Bissau in Africa. Leif SM3RL, one of the members of the expedition, gave a most interesting talk on their experiences and showed us beautiful slides from the trip. Unfortunately, Erik SMØAGD could not attend because he was on his way to US and the Dayton Hamvention.

The hosts had put together an amazingly well-filled program. The VHF/UHF forum was about the Phase III satellite program. Gudmund SM2BYA talked about the Swedish ionosphere research. Talks were also held about antennas and baluns, as well as fox-hunting and AM-SAT. Ulf SM6CVE exhibited his valuable radio stamp collection.

No major controversial matters are under discussion amongst Swedish hams for the time being, but two motions were about the planned change within IARU Region 1 for channel separation on the 2-meter FM band from 25 kHz to 12.5 kHz. With only nine repeater channels, of which two have been taken by the satellites operating on 145.800 MHz and above, this is an issue of concern amongst the fast-growing 2-meter FM population all over Europe.

SSA has a membership of about 7,000. Usually, this annual event draws about 400 members, but many more are taking part in the affairs through proxy. Election of the members of the Board is done by mail. SSA president is Bo Lindberg SMØHDP, and the secretary is Stig Johansson SMØCWC. Every one of the eight call areas has one representative elected by the members in that area.

WSRA AWARD

How about getting an award from another of the capitals of the world? Stockholm Radioamateurs (SRA), SKØAR, issues the Worked Stockholm Radio Amateurs Award. The rules are:

1. Any licensed radio amateur can apply for the WSRA award.
2. Two-way contacts with SRA members required as follows: Swedish hams—10 different SRA members; all others—6 different SRA members.
3. The contacts shall be on phone, CW, mixed.
4. All amateur bands can be used.
5. Crossband contacts do not count.
6. All contacts have to be made from the same call area with the same callsign.
7. Contacts made after January 1, 1960, are valid.
8. Send your listing of QSL cards received (but do not send the cards) to WSRA Award Manager, Olle Engdahl SMØIEA, Morbydalen 1, 8 tr., S-182 32 Danderyd, Sweden.
9. Please have the QSL listing verified by two licensed hams and enclose either Sw. crowns 15.–, US$3.00, or 8 IRCs with the application.

SCANDINAVIAN ACTIVITY CONTEST

The SAC is sponsored by the four Scandinavian leagues with responsibility rotating so that each club has the job with the contest logs every fourth year. The contest takes place the two last weekends in September; in 1983, CW on September 17–18 and phone, September 24–25.

This is one of the contests that follow the IARU recommendation for national contests not to cover all of the bands. That is the reason why you in the SAC should leave the lower and higher portions of each band free from contest operation so non-contesters can chew the rag somewhere. The details for the contest are usually published in contest columns. See you in the Scandinavian Activity Contest in September.

Area	State	Capital	Deg/Min (North)	Deg/Min (West)
1	Zulia	Maracaibo	10 37	71 40
	Falcon	Coro	11 23	69 45
	Trujillo	Trujillo	9 25	70 20
2	Tachira	San Cristobal	7 30	72 15
	Barinas	Barinas	9 37	70 12
	Merida	Merida	8 30	71 2
3	Lara	Barquisimeto	9 55	69 15
	Yaracuy	San Felipe	10 10	68 50
	Portuguesa	Guanare	9 03	69 45
4	Carabobo	Valencia	10 37	68 00
	Aragua	Maracay	10 15	67 35
	Cojedes	San Carlos	9 40	68 36
5	Federal District	Caracas	10 25	66 50
	Miranda	Los Teques	10 21	67 03
	Guarico	San Juan de los Morros	10 05	67 23
6	Bolivar	Ciudad Bolivar	8 00	63 30
	Anzoategui	Barcelona	10 12	64 45
7	Sucre	Cumana	10 28	64 10
	Nueva Esparta	La Asuncion	11 00	64 00
8	Monagas	Maturin	9 42	63 18
	Fed. Terr. Delta Amacuro	Tucupita	9 05	62 05
9	Apure	San Fernando	7 50	67 30
	Fed. Terr. Amazonas	Puerto Ayacucho	5 40	67 35
0	Aves Island		15 41	63 38

Table 1.

VENEZUELA

Luis E. Suarez OA4KO/YV5
Apartado 66994
Caracas 1061-A
Venezuela

Foreign correspondent!! Can you imagine that? It was exciting to receive the offer from *73*'s technical editor, Avery Jenkins WB8JLG. Back home from the mail office, I shouted the news from my home's door. My wife and daughters said almost at once: "You must accept it!" I accepted, and here I am, as a foreign correspondent for *73* in Venezuela.

I'm Peruvian and have been living in this beautiful country for around ten years. I live with my wife Olga and two daughters, Barby, 13, and Susy, 12. I'm a communications consultant and have been a licensed amateur since 1959. As per Venezuelan communications regulations, I'm OA4KO/YV5.

I have talked about me, and now let me talk about the country where I live. Venezuela is one of the eleven independent countries on the South American continent. It was a Spanish colonial possession until April 19, 1810. The national territory is located at the north of South America between the Caribbean Sea, Brazil, Colombia, and the Republic of Guyana. The coordinates at mid-country are 8°48" North and 67° West. So you know roughly where to beam your antenna while listening to a YV. In the accompanying table, I have listed more accurate coordinates. The surface area is 912,050 square kilometers (1/8 the US territory and twice that of France). The population is 14,500,000. There are around 16,000 licensed amateurs and a zillion CBers, both licensed and pirates.

A federal constitution sets forth 20 states, a federal district, two federal territories and 72 islands. Each state has a governor designated by the president and a legislature. There is a federal government with executive, legislative, and judicial branches. The president is elected for a 5-year period, but he cannot be reelected before an elapse of two presidential periods.

The official language is Spanish. There is freedom of religion but most people profess to be Roman Catholics. The people here like baseball, boxing, basketball, and football (soccer), in that order. So, from a sports point of view, we like the same athletic activities as people in the USA. Many Venezuelans are baseball players in the USA and many are well-known in Japan, too. Most baseball games from the US are retransmitted by local TV, and the most important of both the National and the American League games are directly transmitted. Needless to say, the World Series is also transmitted directly. But don't think that baseball is the first sport in South America. No, sir, football (soccer) is number one in all SA countries except Venezuela.

For radio communications purposes, the country is divided into the ten call areas (circuitos) shown in Table 1.

I will write in following columns about requirements for licensing, reciprocity, VHF repeaters, radio clubs, awards, contests, satellite activities, EME, etc., and also include some news about YVØ (Isla de Aves) for all those DX chasers. Furthermore, some paragraphs regarding this country will always be included to let you know more about Venezuela.

NEW EGBERT II
RTTY--CW
for
THE APPLE COMPUTER
SOFTWARE
ONLY

NO TU REQUIRED

Many Standard and UNIQUE FEATURES
(ALL ON ONE DISK)
any MARK and SPACE frequency.
500 Hz to 3000 Hz

CAN BE USED WITH TTY FOR THE DEAF
Requirements: Apple II 48K, 3.3
TRANSMIT OR RECEIVE
ALSO ACCEPTS TTL INPUT TO GAME I/O
C.W. VERSION AVAILABLE

PRICES: RTTY $39.95
Back-Ups each ..... $ 7.50
C.W. $39.95
RTTY with CW $59.95
*Shipping ..... $ 2.50

WRITE FOR DETAILS OR ORDER FROM:

W.H. NAIL COMPANY
275 Lodgeview Drive
Oroville, Ca. 95965 ✓244
(916) 589-2043

*Foreign Shipping - $6.00
(Calif. Residents add 6% tax)

Radio World

CENTRAL NEW YORK'S MOST COMPLETE HAM DEALER

Featuring Kenwood, Yaesu, Icom, Drake, Ten-Tec, Swan, Dentron, Alpha, Robot, MFJ, Tempo, Astron, KLM, Hy Grain, Mosley, Larsen, Cushcraft, Hustler, Mini Products, Bird, Mirage, Vibroplex, Bencher, Info-Tech, Universal Towers, Callbook, ARRL, Astatic, Shure, Collins, AEA. *We service everything we sell!*
Write or call for quote. **You Won't Be Disappointed.**
We are just a few minutes off the NYS Thruway (I-90) Exit 32

VISA — master charge

OUT OF STATE ORDER TOLL FREE 800-448-9338
✓397
ONEIDA COUNTY AIPORT TERMINAL BUILDING
ORISKANY, NEW YORK 13424
N.Y. Res. Call (315) 736-0184
Warren - K2IXN
Bob - WA2MSH
Al - WA2MSI

. . . at last . . .
your shack organized!
A beautiful piece of furniture — your XYL will love it!

$184.50 S-F RADIO DESK
Deluxe - Ready to Assemble

Designed with **angled** rear shelf for your viewing comfort and ease of operation.
FINISHES: Walnut or Teak Stain.
Floor Space: 39" Wide by 30" Deep
Additional Information on Request.
Checks, Money Orders, BankAmericard and Master Charge Accepted.
F.O.B. Culver City. (In Calif. Add 6% Sales Tax.)
DEALER INQUIRIES INVITED

Also Available . . . .
Floor Space: 51" Wide by 30" Deep
$199.50

✓65

S-f Amateur Radio Services
4384 KEYSTONE AVENUE • CULVER CITY, CALIF. 90230 — PHONE (213) 837-4870

"AUTHOR AUTHOR!"

The call for authors is out!

Wayne Green Books announces an October 1, 1983 deadline for submitting manuscript proposals for the upcoming publication list. Ideas for book-length manuscripts about any microcomputer system or area of electronics will be considered. In addition to payment and royalties, we offer our distribution channels and the marketing support your book deserves.

Send proposals or requests for a copy of our Writer's Guide to:
Editor, **Wayne Green Books**
Peterborough, NH 03458.
Or call **toll-free 1-800-343-0728.**

MAKE IT
EASY TO SAVE
your copies of

73 Magazine

Your magazine library is your prime reference source—keep it handy and keep it neat with these strong library shelf boxes. They are made of white corrugated cardboard and are dust resistant. Use them to keep *all* your magazines orderly yet available for constant reference.

Self-sticking labels are available for the following:

80 Micro	*73 Magazine*	*Radio Electronics*
Microcomputing	*QST*	*Personal Computing*
inCider	*CQ*	*HOT CoCo*
Desktop Computing	*Ham Radio*	*Interface Age*

One box (BX1000) is $2.00, 2-7 boxes (BX1001) are $1.50 each, and 8 or more boxes (BX1002) are $1.25 each. Be sure to specify which labels we should send.

Call **TOLL-FREE** for credit card orders:
1-800-258-5473

73 Magazine
Attn: Book Sales, Peterborough, NH 03458

☐ SHIPPING AND HANDLING CHARGES $2.00 per order, up to and including a quantity of eight. 25¢ for each additional box ordered. ☐

RAMSEY ELECTRONIC'S Inc.

PARTS WAREHOUSE

We now have available a bunch of goodies too good to bypass. Items are limited so order today.

2575 Baird Rd.
Penfield, NY 14526
716-586-3950

Call your Phone Order in Today. TERMS: Satisfaction guaranteed or money refunded. C.O.D. add $2.50. Minimum order $6.00. Orders under $10.00 add $1.50. Add 6% for postage, insurance, handling. Overseas add 15%. N.Y. residents add 7% tax.

MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit **$14.95**
FM-3 Wired and Tested **19.95**

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1 **$8.95**

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 **$2.95**

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker. Complete kit, BN-9 **$5.95**

CPO-1

Runs on 3-12 Vdc 1 watt out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **$2.95**

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit **$3.95** FM-2 kit **$4.95**

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC. Complete kit, WL-1 **$6.95**

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation. 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 **$5.95**

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit **$5.95**

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC.

MB-1 Kit **$4.95**

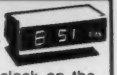
Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker. Complete kit, SM-3 **$2.95**

60 Hz Time Base

Runs on 5-15 VDC. Low current (2 5ma). 1 min month accuracy. TB-7 Kit **$5.50**
TB-7 Assy **$9.95**

CLOCK KITS



Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5 **$24.95**
Clock with 10 min. ID timer, 12/24 hour, DC-10 **$29.95**
Alarm clock, 12 hour only, DC-8 **$29.95**
12V DC car clock, DC-7 **$29.95**

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

SATELLITE TV KIT

THE POPULAR SAT-TEC RECEIVER IN KIT-FORM!

Featured in a Radio Electronics magazine cover story (May 82), the reliable R2B Sat-tec TV receiver is now operating in thousands of locations. The R2B is easy to build, pre-etched, plated boards with screened component layout assures accurate component placement and the critical IF section and local oscillator are pre-assembled and aligned! All parts are included for the R2B, attractive case, power supply, descriptive operating manual as well as complete assembly instructions. Features of the receiver include: dual conversion design for best image rejection, fully tunable audio to recover 'hidden' subcarriers, divide by two PLL demodulator for excellent threshold performance, tight tracking AFC to assure drift free reception, and of course, full 24 channel tunable coverage.

Build your satellite TV system around the R2B, close to ten thousand others already have and now it's available in kit form at a new low price. Order yours today.

A complete Satellite TV System requires a dish antenna, LNA (low noise amplifier), Receiver and Modulator.

R2B Receiver Kit $359.00
R2B Receiver, Wired and Tested $595.00
120° K Avantek LNA $495.00
RM3 RF Modulator $49.95
Prices include domestic UPS shipping and insurance.

PARTS PARADE

IC SPECIALS

LINEAR

301	$ .35
324	$1.50
380	$1.50
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .50
3914	$2.95
8038	$2.95

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

FERRITE BEADS

With info and specs. 15/$1.00
6 Hole Balun Beads 5/$1.00

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7651 .43" C.A.	2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
2N4916 FET C+F	4/$1.00
2N5401 PNP C+F	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	$.80
2N2646 UJT	3/$2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge **$1.50 each**

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ⅛" center. ½" leads. bag of 300 or more **$1.50**

Switches

Mini toggle SPDT **$1.00**
Red Pushbuttons N.O. **3/$1.00**

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc. 5 for $1.00

Mini 8 ohm Speaker

Approx 2¼" diam. Round type for radios, mike etc. **3 for $2.00**

Solid State Buzzers

small buzzer 450 Hz, 86 dB sound output on 5-12 vdc at 10-30 mA, TTL compatible **$1.50**

Slug Tuned Coils

Small 3/16" Hex Slugs, turned coil. 3 turns 10 for $1.00

AC Outlet

Panel Mount with Leads **4/$1.00**

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic	DISK CERAMIC
1.5 uF 25V 3/$1.00	1000 uF 16V Radial $.50	.01 16V disk 20/$1.00
1.8 uF 25V 3/$1.00	500 uF 20V Axial $.50	1 16V 15/$1.00
.22 uF 25V 3/$1.00	150 uF 16V Axial 5/$1.00	.001 16V 20/$1.00
	10 uF 15V Radial 10/$1.00	100 pF 20/$1.00
		.047 16V 20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **$1.25**

Ceramic IF Filters

Mini- SOLD OUT 7 kHz
B.W. 3 kHz $1.50 ea.

Trimmer Caps

Sprague - 3-40 pf
Stable Polypropylene **.50 ea.**

25K 20 Turn Trim Pot **$1.00**
1K 20 Turn Trim Pot **$.50**

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Coax Connector

Chassis mount BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips **5 for $1.00**
⅜" Rubber Grommets **10 for $1.00**

Parts Bag

Asst. of chokes, disc caps, tant. resistors, transistors, diodes, MICA caps etc. sm. bag (100 pc) **$1.00** lg. bag (300 pc) **$2.50**

Connectors

6 pin type gold contacts for mA-1003 car clock module price **.75 ea.**

Leds

- your choice, please specify
Mini Red, Jumbo Red, High Intensity Red, Illuminator Red **8/$1**
Mini Yellow, Jumbo Yellow, Jumbo Green **6/$1**

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - **.50 each or 3/$1.00**

Crystals

3.579545 MHZ	$1.50
10.00000 MHZ	$5.00
5.246800 MHZ	$5.00

AC Adapters

Good for clocks, ricad chargers, all 110 VAC plug one end.

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Audio Prescaler

Make high resolution audio measurements, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity, specify -10 or -100.

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V ct 1 A and 24 VCT. Complete kit, PS-3LT **$6.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit **$6.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.

50 for only $9.00 SOLD OUT **10 for $2.00**

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nuba

Nice precut pces of shrink size 1" x ¼" shrink to ⅛". Great for splices **50/$1.00**

Mini TO-92 Heat Sinks

Thermalloy Brand **5 for $1.00**
To-220 Heat Sinks **3 for $1.00**

Opto Isolators - 4N28 type **$.50 ea.**
Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for $1.00**

CDS Photocells

Resistance varies with light, 250 ohms to over 3 meg **3 for $1.00**

See List of Advertisers on page 114

NEW LOW-NOISE PREAMPS

New low-noise microwave transistors make preamps in the 0.9 to 1.0 dB noise figure range possible without the fragility and power supply problems of gas-fet's. Units furnished wired and tuned to ham band. Can be easily retuned to nearby freq.

Models LNA( ), P30, and P432 shown

Model	Tunable Freq Range	Noise Figure	Gain	Price
LNA 28	20-40	0.9 dB	20 dB	$39.95
LNA 50	40-70	0.9 dB	20 dB	$39.95
LNA 144	120-180	1.0 dB	18 dB	$39.95
LNA 220	180-250	1.0 dB	17 dB	$39.95
LNA 432	380-470	1.0 dB	18 dB	$44.95

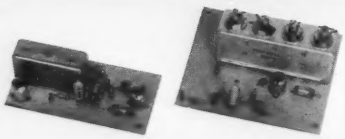
ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $14.95
- P30C, VHF Kit with case $20.95
- P30W, VHF Wired/Tested $29.95
- P432K, UHF Kit less case $18.95
- P432C, UHF Kit with case $24.95
- P432W, UHF Wired/Tested $33.95

P432 also available in broadband version to cover 20-650 MHz without tuning. Same price as P432; add "B" to model #.

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier similar to the LNA series and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Noise figure = 1 to 1.2 dB. Gain = 12 to 15 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49.95
HRA-220	213-233 MHz	$49.95
HRA-432	420-450 MHz	$59.95

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit $44.95	50-54	144-148
Less Case $39.95	144-146	28-30
Wired $59.95	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit $54.95	432-436	144-148
Less Case $49.95	432-436	50-54
Wired $74.95	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.

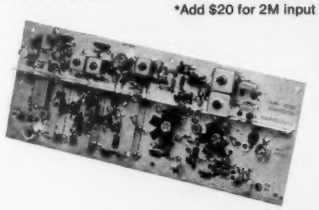
SPECIAL FREQUENCY CONVERTERS made to custom order $119.95. Call for details.

TRANSMIT CONVERTERS

For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 watts output.

	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79.95	28-30	50-52
Wired $119.95	27-27.4	144-144.4
(Specify band)	28-30	220-222*
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99.95	50-54	432-436
Wired $149.95	61.25	439.25
	144-148	432-436*

*Add $20 for 2M input



VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Kits from $69.95.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

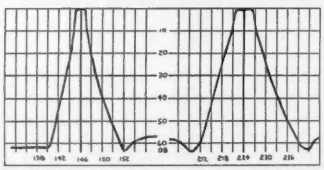
FM-5 PC Board Kit – **ONLY $159.95** complete with controls, heatsink, etc. 10 Watts, 5 Channels, for 6M, 2M, or 220

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $59.95

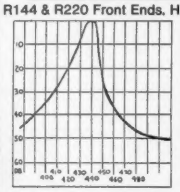
REPEAT OF A SELLOUT!

While supply lasts, get $59.95 cabinet kit free when you buy an FM-5 Transceiver kit. Where else can you get a complete transceiver for only $159.95?

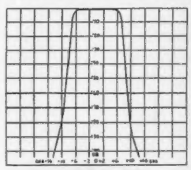
LOOK AT THESE ATTRACTIVE CURVES!



R144 & R220 Front Ends. HRA 144/220, & HRF-144/220

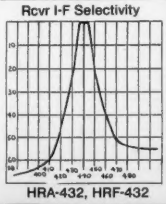


R451 Receiver Front End



Rcvr I-F Selectivity

Typical Selectivity Curves of Receivers and Helical Resonators.



HRA-432, HRF-432

- **Call or Write for FREE CATALOG**
  (Send $1.00 or 4 IRC'c for overseas mailing)
- Order by phone or mail ● Add $2 S & H per order
  (Electronic answering service evenings & weekends)
  Use VISA, MASTERCARD, Check, or UPS COD.

hamtronics, inc.
65-X MOUL RD. ● HILTON NY 14468
Phone: 716-392-9430
Hamtronics® is a registered trademark

AT LAST — A REPEATER YOU CAN AFFORD!

For years, Hamtronics ® Modules have been used by individual hams and manufacturers to make repeaters. Now, in the Hamtronics tradition of top quality and superb value, we are proud to offer a complete repeater package.

JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
6M,2M,220	$595	$745
440	$645	$795

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

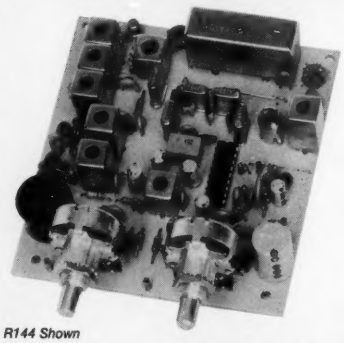
Also available for remote site linking/crossband & 10M.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.3 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY-TUNE TRANSMITTER; UP TO 20 WATTS OUT.

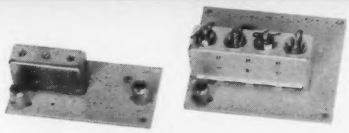
HIGH QUALITY MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.

INTRODUCING — NEW 1983 RECEIVERS



R144 Shown

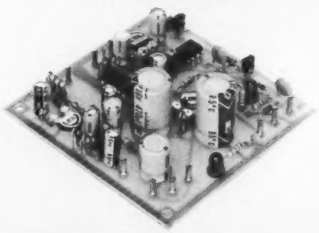
- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity (curves at left). AFC incl., xtal oven avail. Kit only $119.95
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $119.95.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $109.95. Also avail w/4 pole filter, only $94.95/ kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $84.95
- **R110 UHF AM RECEIVER** for UHF uses, including special 259 MHz model to hear SPACE SHUTTLE. Kit $94.95



- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

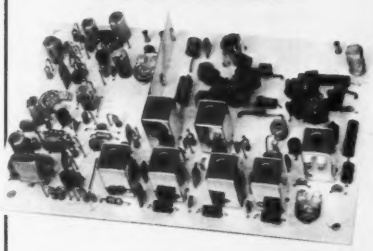
  HRF-144 for 143-150 MHz $34.95
  HRF-220 for 213-233 MHz $34.95
  HRF-432 for 420-450 MHz $44.95

  (See selectivity curves at left.)



- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
- **CWID KITS** 158 bits, field programmable, clean audio. Only $59.95.
- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $89.95.
- **AUTOPATCH KITS.** Provide repeater autopatch, reverse patch, phone line remote control of repeater, secondary control via repeater receiver. Many other features. Only $89.95. Requires DTMF Module.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.

TRANSMITTERS AND ACCESSORIES



- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $59.95

- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent. Kits only $69.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

hamtronics®

33

SPECIALISTS · CUSHCRAFT · DRAKE · HAM KEY · HUSTLER · HY-GAIN · ICOM · KANTRONICS · LARSEN · MFJ · MORGAIN · PANASONIC · RAMSEY · SHURE · SONY · TELEX · TEN TEC · TRAC · TRANSCOM · VAN GORDON · VOCOM · ANTENNA SPECIALISTS · AVANTI · ARRL PUBS · AMECO · BASH · BEARCAT · BENCHER · B&W · BIRD · CALLBOOK · COMMUNICATIONS

POPULAR VALUES FROM SPECTRONICS!

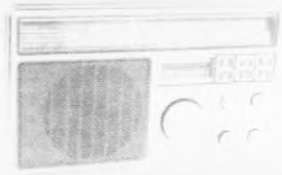
SAVE $$$

AM/FM/AIR/PSB/2 METERS!

ONLY $69.95 plus $2.00 UPS

THE NEW PANASONIC RF-1405 HAS IT ALL!

Portability and practicality are built right in to this newest Panasonic receiver, not to mention LOW PRICE!



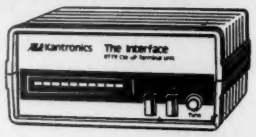
- AC/DC power
- AM 525-1610 KHz.
- FM 88-108 MHz.
- AIR 108-136 MHz.
- PSB 136-174 MHz.

Put Your Computer "On-The-Air"

The Interface™

List ~~$180.95~~ $149.95

Plus $3.00 Shipping



Your personal computer becomes a complete CW/RTTY/ASCII send and receive terminal with **The Interface** linking it to your transceiver.

If you own an Apple II or Apple II Plus, Atari 400 or 800, TRS-80 Color Computer, or VIC-20, **The Interface** will put your computer "On-The-Air".

Software for each system features split screen display, buffered keyboard, status display, and message ports. Attach any Centronics compatible printer for hard copy. Software is available on diskette for the Apple and program boards for the others, at additional cost.

Apple diskette	Atari board	VIC-20 board	TRS-80C board	TI-99 board	VIC-20 Hamtext	Commodore 64 Hamtext
$29.95	$49.95	$49.95	$59.95	$99.95	$99.95	$99.95

REPEATING 9-MINUTE DROWSE ALARM CAN BE USED FOR STATION I.D. REMINDER

KEN-TEC 24-HOUR DIGITAL MILITARY TIME ALARM CLOCK

$19.95 PLUS $1.50 UPS

- .7" Red LED Numerals
- 24-Hr. Memory Alarm
- 1-Year Warrantee
- Drowse Control
- Dark Brown Walnut Grain
- 2¼"H x 6¼"W x 3¼"D

"easy-talk'r" VOX PORTABLE TRANSCEIVER

$49.95 ea. plus $3.00 shipping

- Up to ½ mile FM Transmitting
- "Hands free" VOX operation
- Light weight—less than 9 Oz.

Valuable aid for Amateur use in antenna installation, tuning/pruning, field day, etc., plus hundreds of applications in home business, sports and recreation. Uses 9 volt battery (not supplied.)

B&W PORTABLE APARTMENT ANTENNA

$43.75 plus $2.00 shipping

Quick, easy mounting. Tunes 2, 6, 10, 15, 20 and 40 meter Amateur bands plus SW BC bands in some ranges. 360 watts SSB/CW. 22½ whip extends to 57". 1¼" mount includes 5 base loading coils. Weighs less than 2 lbs.

FAMOUS "EAVESDROPPER" SW RECEIVING ANTENNA

$59.95 plus $3.00 shipping (Cont'l U.S.)

ICOM HEADQUARTERS

NEW! IC3AT (220 MHz) IC4AT (440 MHz)

ICOM IC2A, IC2AT

- Compact
- Quality Construction
- Versatile
- Affordable
- Wide Range of Accessories Available

CALL FOR PRICE & AVAILABILITY

AMECO PREAMPS

add $3.00 shipping (Cont'l USA only)

Model PLF-2	$52.95
Model PLF-2E (240V)	$57.95
Model PT-2	$79.95
Model PT-2E (240V)	$84.95

REPLACEMENT NICAD FOR WILSON/YAESU

$26.95 plus $2.00 shipping

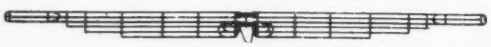
Fits Wilson Mark II, and Mark IV plus Yaesu FT-207. 500 MAH, 11.7 V. Nickel-Cadmium.

SUB-AUDIBLE TONE HEADQUARTERS

ENCODERS $29.95 EACH plus $2.00 shipping (Cont'l USA only)

We stock **Communications Specialists** SS-32 and SS-32M encoders for most any mobile or hand-held applications including the very popular **Icom Handhelds**

MORGAIN MULTI-BAND ANTENNAS



Add $5.00 for shipping (Cont'l U.S.A.)

80-40HD/A 80/40 Mtr bands (69)	99.00	**75-10HD/A** 75/40/20/15/10 Mtr (66)	126.95
75/40HD/A 75/40 Mtr bands (66)	94.50	**80-10HD/A** 80/40/20/15/10 Mtr (69)	132.00

FAMOUS AVANTI THRU-GLASS MOBILE ANTENNA

$32.95 plus $3.00 shipping

The Avanti On-Glass is the first two-way communications antenna that mounts on glass and transmits and receives through the glass. Extremely low VSWR is achieved by adjusting special tuning slug on matching network inside the vehicle. Can be easily removed for car washes without special tools.

NEW! 2.8 dbd GAIN BASE ANTENNA

$15.00 Please add 2.00 shipping any qty

Here's an inexpensive, omni-directional, 144-148 MHz. ½ wave antenna. Fits 1¼" mast, 50 ohm impedance. A real problem solver!

SONY VALUES!

ICF-4800

$69.95 plus $2.00 shipping (Cont'l U.S.)

6-BAND POCKET WORLD RECEIVER

- 6-band pocket world receiver—SW 1-5, plus MW
- Extremely compact and lightweight—palm sized!
- SW band spread dial-easy tuning

9-BAND ICF-7600A $109.95 plus $2.00 UPS

TO ORDER: CALL OR WRITE. MASTER CARD, VISA, MONEY ORDERS, PERSONAL CHECKS TAKE 3 WEEKS TO CLEAR. ACCEPTED. **INTERNATIONAL ORDERS WELCOME**, PLEASE REQUEST PRO FORMA INVOICE. ILLINOIS RESIDENTS ADD 6% SALES TAX.

HOURS: MON. THRU WED. 9:30-6:00, THURS-FRI. 9:30-8:00, SAT. 9:30-3:00

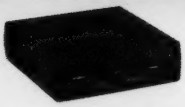
STOP BY AND VISIT WHEN IN THE CHICAGOLAND AREA!!

SPECTRONICS, INC

1009 GARFIELD ST. OAK PARK, IL. 60304

PHONE (312) 848-6777

ramsey the first name in Counters !



9 DIGITS 600 MHz $129.95 WIRED

PRICES:

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

ramsey electronic's, inc. VISA master charge
2575 Baird Rd. Penfield, NY 14526 ↩ 62

PHONE ORDERS
CALL 716-586-3950

TERMS: Satisfaction guaranteed. Examine for 10 days; if not pleased return in original form for refund. Add 5% for shipping, insurance to a maximum of $10. Overseas add 15%. COD add $2. Orders under $10 add $3.50. NY residents add 7% tax.

↩See List of Advertisers on page 114

DEALER DIRECTORY

Culver City CA

Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

Sacramento CA

TOWERS—galvanized steel stack/crankup and accessories. Northern California factory direct to you. **California Antenna Systems, 6020 Windy Ridge Road, Shingle Springs CA 95682, 677-9540.**

San Jose CA

Bay area's newest Amateur Radio store. New & used Amateur Radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1378 So. Bascom Ave., San Jose CA 95128, 998-1103.**

New Castle DE

Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Azden, AEA, Kantronics, Santec. Full Line of Accessories. No Sales Tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

Preston ID

Ross WB7BYZ has the Largest Stock of Amateur Gear in the Intermountain West and the Best Prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Bloomington IL

ROHN TOWERS—Wholesale direct to users. All products available. Write or call for price list. Also we are wholesale distributors for Antenna Specialists, Regency, and Hy-Gain. **Hill Radio, 2503 G.E. Road Box 1405, Bloomington IL 61701-0887, 663-2141.**

Western KY

Sell new and used equipment & service. **L&S Radio, 307 McLean Ave., Hopkinsville KY 42240, 885-8071.**

Framingham MA

ATTENTION HOBBYISTS & EXPERIMENTERS! Now there's a source for parts in your area. We carry audio, video, fans, batteries, capacitors, relays, transformers and much, much more. Open 6 days a week. **Horizon Sales Inc., 59 Fountain St., Framingham MA 01701, 875-4433.**

Littleton MA

The Reliable Ham Store Serving N.E. Full line of ICOM & Kenwood. Yaesu HT's, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

Ann Arbor MI

See us for products like Ten-Tec, R. L. Drake, Dentron and many more. Open Monday through Saturday, 0830 to 1730. WB8VGR, WB8UXO, WD8OKN and W8RP behind the counter. **Purchase Radio Supply, 327 E. Hoover Ave., Ann Arbor MI 48104, 668-8696.**

Buffalo NY
WESTERN NEW YORK

Niagra Frontier's only full stocking Amateur dealer. Also Shortwave, CB, Scanners, Marine, Commercial. Operating displays featuring Yaesu and others. Towers, Antennas, Sales and Service. **DX Communications, 3214 Transit Road, West Seneca NY, 668-8873.**

Amsterdam NY
UPSTATE NEW YORK

Kenwood, ICOM, Drake, plus many other lines, Amateur Dealer for over 35 years. **Adirondack Radio Supply Inc., 185 West Main Street, Amsterdam NY 12010, 842-8350.**

Columbus OH

The biggest and best Ham Store in the midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood Service. **Universal Amateur Radio Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 966-4267.**

Scranton PA

ICOM, Bird, Cushcraft, Beckman, Fluke, Larsen, Hustler, Antenna Specialists, Astron, Avanti, Belden, W2AU/W2VS, AEA, Vibroplex, HamKey, Amphenol, Sony, B&W, Coax-Seal, Cover Craft, J.W. Miller/Diawa, ARRL, Ameco, Shure. **LaRue Electronics, 1112 Grandview St., Scranton PA 18509, 343-2124.**

Mountaintop PA
WILKES-BARRE AREA

VHF/UHF Equipment & Supplies—From HT's to kW Amplifiers, Transverters, Connectors, VHF/UHF Microwave Linear Amplifiers, GaAsFET Preamps, OSCAR Equipment, Low Noise preamps, Antennas, Power Supplies. From: Lunar, Microwave Modules, UHF Units/Parabolic, ARCOS, Astron, F9FT-Tonna, Tama, DenTron, KLM, Mirage, Santec, Tokyo Hy-Power, Amphenol. Two stamps for catalog. **The VHF SHOP, Dept. S, RD4, Box 349, Mountaintop PA 18707, 868-6565.**

Dallas TX

IBM PC/Apple aftermarket products; hobbyists' electronics project kits: $50.00 complete modem kit, subscription/satellite TV decoder kits, EPROM programmer/duplicator, popular memory IC testers, data sheets, application notes, and more than 6000 parts in stock. Semiconductors, discretes, video products, tools. . . Please write for your free literature/catalog. **Independent Electronics, 6415-06 Airline Rd., Dallas TX 75205.**

Baltimore/Washington

Avantek transistors, amplifiers, oscillators and LNAs. Coaxial cable and connectors. Blonder Tongue dealer with Microwave laboratory. **Applied Specialties, Inc., 10101G Bacon Drive, Beltsville, Maryland 20705. Wash. 595-5393, Balt. 792-2211. 7:30 a.m. to 6:00 p.m. Monday thru Friday.**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the Nov. '83 issue must be in our hands by Sept. 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	3A	7	7	7A	14	14	14
ARGENTINA	14A	14	14	14	7A	7	14A	21	21A	21A	21A	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	7B	7B	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7A	14A	21	21A	21A	21A
ENGLAND	7	7	7	7	7	7	14	14A	14A	21	14A	14
HAWAII	21	14	7	7B	7B	7	7	7	14	14A	21	21
INDIA	14B	7B	7B	7B	7B	7B	14	14	14	14	14B	14B
JAPAN	14	14B	7B	7B	7B	7B	7	7	7B	7B	7B	14A
MEXICO	14A	14	7A	7A	7	7	7A	21	21	21	21A	21
PHILIPPINES	14	7B	7B	7B	7B	7B	7B	7B	14B	14	14	14
PUERTO RICO	14	7	7	7	7	7	7A	14	14A	21	14A	14A
SOUTH AFRICA	14	7	7	7B	7B	14	21	21	21A	21A	21A	14A
U. S. S. R.	7	7	7	7	7	7	14	14	14	14	14B	7B
WEST COAST	14A	14	7	7	7	7	7	14	14A	14A	21	21

CENTRAL UNITED STATES TO:

ALASKA	14	14	7A	7	7	3A	7	7	7A	14	14	14
ARGENTINA	14A	14	14	14	7A	7	7A	14A	21A	21A	21A	21
AUSTRALIA	21	14	14B	7B	7B	7B	7B	7B	7B	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7A	14A	21	21A	21A	21A
ENGLAND	7	7	7	7	7	7	14	14	14A	14A	14	14
HAWAII	21	14A	14	7	7	7	7	7	14	14A	21	21
INDIA	14B	14	7B	7B	7B	7B	7B	14	14	14	14B	14B
JAPAN	14	14	7B	7B	7B	7B	7	7	7B	7B	14	14A
MEXICO	14	14	7	7	7	7	7	7A	14	14	21	21
PHILIPPINES	14	14	7B	7B	7B	7B	7B	14B	14	14	14	14A
PUERTO RICO	21	14	7A	7A	7	7	14	14A	21	21	21A	21A
SOUTH AFRICA	14	7	7	7B	7B	7B	14	14A	21	21	21	14A
U. S. S. R.	7	7	7	7	7	7	7B	14	14	14	14B	7B

WESTERN UNITED STATES TO:

ALASKA	14	14	7A	7	7	3A	7	7	7	7A	14	14
ARGENTINA	14A	14	14	14	7A	7	7B	14	21A	21A	21A	21
AUSTRALIA	21A	21A	14A	14	14	14B	7B	7B	7B	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7	14A	21	21A	21A	21A
ENGLAND	7B	7	7	7	7	7B	7B	7B	14	14	14	14
HAWAII	21A	21	14A	14	7	7	7	7	14	14A	21	21A
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14B	14B
JAPAN	14	14	14	7B	7	7	7	7	7	7	14	14A
MEXICO	14A	14	7	7	7	7	7	14	14A	21	21A	21
PHILIPPINES	14A	14	14	14B	7B	7B	7B	7	14B	14	14	14A
PUERTO RICO	21	14	7A	7A	7	7	14	14A	21	21	21A	21A
SOUTH AFRICA	14	7	7	7B	7B	7B	7B	14	21	21	21	14A
U. S. S. R.	7B	7	7	7	7B	7B	7B	7B	14	14	14B	7B
EAST COAST	14A	14	7	7	7	7	7	14	14A	14A	21	21

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

SEPTEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
				1 P/F	2 P/F	3 F/G
4 F/G	5 F/G	6 F/G*	7 P/P*	8 P/P	9 P/F	10 F/G
11 F/G	12 F/G	13 F/F	14 P/F	15 P/F*	16 F/G	17 G/G
18 G/G	19 G/G	20 F/G	21 F/F	22 F/F	23 P/F	24 P/F
25 F/G	26 F/G	27 F/G	28 F/G	29 F/F*	30 P/F*	

YAESU FT-726R TRIBANDER

NEW GALAXIES OF PERFORMANCE ON VHF AND UHF

FULL DUPLEX!!

\TELLITES!! SCATTER!!

/!! EME!!

The New Yaesu FT-726R Tribander is the world's first multiband, multimode Amateur transceiver capable of full duplex operation. Whether you're interested in OSCAR, moonbounce, or terrestrial repeaters, you owe yourself a look at this one-of-a-kind technological wonder!

Multiband Capability

Factory equipped for 2 meter operation, the FT-726R is a three-band unit capable of operation on 10 meters, 6 meters, and/or two segments of the 70 cm band (430-440 or 440-450 MHz), using optional modules. The appropriate repeater shift is automatically programmed for each module. Other bands pending.

Advanced Microprocessor Control

Powered by an 8-bit Central Processing Unit, the ten-channel memory of the FT-726R stores both frequency and mode, with pushbutton transfer capability to either of two VFO registers. The synthesized VFO tunes in 20 Hz steps on SSB/CW, with selectable steps on FM. Scanning of the band or memories is provided.

Full Duplex Option

The optional SU-726 module provides a second, parallel IF strip, thereby allowing full duplex crossband satellite work. Either the transmit or receive frequency may be varied during transmission, for quick zero-beat on another station or for tracking Doppler shift.

High Performance Features

Borrowing heavily from Yaesu's HF transceiver experience, the FT-726R comes equipped with a speech processor, variable receiver bandwidth, IF shift, all-mode squelch, receiver audio tone control, and an IF noise blanker. When the optional XF-455MC CW filter is installed, CW Wide/Narrow selection is provided. Convenient rear panel connections allow quick interface to your station audio, linear amplifier, and control lines.

Leading the way into the space age of Ham communications, Yaesu's FT-726R is the first VHF/UHF base station built around modern-day requirements. If you're tired of piecing together converters, transmitter strips, and relays, ask your Authorized Yaesu Dealer for a demonstration of the exciting new FT-726R, the rig that will expand your DX horizons!

Price And Specifications Subject To Change Without Notice Or Obligation

YAESU *The radio.* 483

YAESU ELECTRONICS CORPORATION 6851 Walthall Way, Paramount, CA 90723 • (213) 633-4007
YAESU CINCINNATI SERVICE CENTER 9070 Gold Park Drive, Hamilton, OH 45011 • (513) 874-3100

Digital DX-terity...

General coverage, Superior dynamic range, 2 VFO's, 8 memories, Scan, Notch...COMPACT!

TS-430S

The TS-430S combines the ultimate in compact styling with advanced circuit design and performance. An all solid-state SSB, CW, and AM transceiver, with FM optional, covering the 160-10 meter Amateur bands, it also incorporates a 150 kHz-30 MHz general coverage receiver having a superior dynamic range, dual digital VFO's, 8 memories, memory scan, programmable band scan, IF shift, notch filter, all-mode squelch, and built-in speech processor.

TS-430S FEATURES:

- **160-10 meter operation, with general coverage receiver**
  With 160-10 meter Amateur band coverage, including WARC 30, 17, and 12 meter bands, it also features a 150 kHz-30 MHz general coverage receiver. Innovative UP-conversion digital PLL circuit, for superior frequency stability and accuracy. UP/DOWN band switches for Amateur bands or 1-MHz steps across entire 150 kHz-30 MHz range. Two digital VFO's continuously tuneable from band to band. Band information output on rear panel.
- **USB, LSB, CW, AM, with optional FM**
  Operates on USB, LSB, CW, and AM, with optional FM, internally installed. AGC time constant automatically selected by mode.
- **Compact, lightweight design**
  Measures only 10-5/8 (270) W x 3-3/4 (96) H x 10-7/8 (275) D, inches (mm), weighs only 14.3 lbs. (6.5 kg.).
- **Superior receiver dynamic range**
  Use of 2SK125 junction-type FET's in the Dyna-Mix high sensitivity, balanced, direct mixer circuit provides superior dynamic range.
- **10-Hz step dual digital VFO's**
  10-Hz step dual digital VFO's operate independently, include band and mode information. Different band and mode cross operation possible. Dial torque adjustable. STEP switch for tuning in 10-Hz or 100-Hz steps. A=B switch quickly shifts "B" VFO to the same frequency and mode as "A" VFO, or vice-versa. VFO LOCK switch provided. RIT control tunes VFO or memory. UP/DOWN manual scan possible using optional microphone.
- **Eight memories store frequency, mode, and band data**
  Memories store frequency, mode, and band data. Eighth memory stores receive and transmit frequencies independently. M.CH switch for operation of memory as independent VFO, or fixed frequency.
- **Lithium battery memory back-up**
  Estimated five-year life.
- **Memory scan**
  Scans memories in which data is stored.
- **Programmable automatic band scan**
  Scans programmed band width. Scan speed adjustable. HOLD switch interrupts band or memory scan.
- **IF shift circuit for minimum QRM.**
  IF passband may be moved to place interferring signals outside the passband, for best interference rejection.
- **Tuneable notch filter built-in**
  Deep, sharp, tuneable, audio notch filter.
- **Narrow-wide filter selection**
  NAR-WIDE switch for IF filter selection on SSB, CW, or AM, when optional filters are installed. (2.4 kHz IF filter built-in.)
- **Speech processor built-in**
  Improves intelligibility, increases average "talk-power."
- **Fluorescent tube digital display**
  Indicates frequency to 100 Hz (10 Hz modifiable).
- **All solid-state technology**
  Input rated 250 W PEP on SSB, 200 W DC on CW, 120 W on FM (optional), 60 W on AM. Built-in cooling fan, multi-circuit final protection. Operates on 12 VDC, or 120/220/240 VAC with optional PS-430 AC power supply.
- **All-mode squelch circuit, built-in**
- **Noise blanker, built-in**
- **RF attenuator (20 dB)**
- **Vox circuit, plus semi break-in with side-tone**

Optional AT-250 Automatic Antenna Tuner
Designed to match the TS-430S in size, color, and appearance. Functionally compatible with any HF transceiver of 200 watts PEP or lower. (Requires manual bandswitching.)
• Covers 160-10 meter incl. WARC
• ABC Automatic Band Changing System (when used with TS-430S) • SWR/Power meter • 4 antenna terminals • Built-in AC Power Supply.

Other optional accessories:

- PS-430 compact AC power supply.
- PS-30 or KPS-21 AC power supplies.
- SP-430 external speaker.
- MB-430 mobile mounting bracket.
- AT-130 compact antenna tuner, 80-10 m incl. WARC.
- FM-430 FM unit.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filters.
- YK-88SN (1.8 kHz) narrow SSB filter.
- YK-88A (6 kHz) AM filter.
- MC-42S UP/DOWN hand microphone.
- MC-60A deluxe desk microphone, UP/DOWN switch.
- MC-80 UP/DOWN desk microphone.

More information on the TS-430S is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

KENWOOD

...pacesetter in amateur radio

Specifications and prices are subject to change without notice or obligation.